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## ABSTRACT

Six papers describe use of the radio for in-school and out-of-school formal education in this first volume of working papers on how radio can and is being used for education and development. Part one on in-school education contains: a Nicaraguan project to teach mathematics to first grade children (including curriculum, materials, teacher activities, problems, and envisioned solutions); an evaluation of the radio schools of Tarahumara, Mexico, begun by Jesuit missionaries in 1955, geared toward first-fourth grades; the "Radioprimeria" project headquartered in San Luis Potosi, Mexico, begun in 1970 for fourth-sixth graders in rural areas (format, materials, student participation, and gradual shift from rural to urban use are discussed); a planning study on potential of radio in elementary formal education in Indonesia (covering existing elementary education system and estimates of comparative performances and costs of alternatives). Part two deals with use of radio for distance learning: for inservice training of teachers in Kenya (distinguished by use of correspondence materials supplemented by radio broadcasts to reach a widely scattered adult population) and in Radio Santa Maria's primary and intermediate adult education program in the Dominican Republic (adapted from a model developed in the Canary Islands, Spain). (RS)

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# Radio for Education and Development: Case Studies

## Volume I

World Bank Staff Working Paper No. 266

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## Preface

As early as the 1920s educational authorities began using radio to supplement instruction within schools and to extend the reach of education outside of schools. Though radio has continued to be used for education since then, attention shifted during the 1950s and 1960s toward the more glamorous and costly medium of television. In recent years, however, interest in radio has revived, and, in order to improve its information base on radio's potential for education and development, the Education Department of the World Bank funded an effort to bring together a number of reports of project experience. This document is one output of that effort. In it are papers describing radio's use for in-school education, for formal education out-of-school, for non-formal education, and for interactive development communications. Most of the papers are case studies of project experiences; several of them are more general papers to assist in planning radio's use.

This volume of case studies forms a natural successor to the radio case studies in the International Institute for Educational Planning's 1966 study on the New Educational Media in Action: Case Studies for Planners. And, as with the IIEP case studies, a companion volume synthesizing the results of these cases and other experiences is being prepared. This companion volume, written by Dean T. Jamison and Emily G. McAnany, will be published later this year.

Although the World Bank supported the compilation of these case studies, the conclusions and opinions they express should not necessarily be considered to represent the Bank's views or policies.

Mats Hultin  
Acting Director  
Education Department  
The World Bank

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Peter L. Spain  
Dean T. Jamison  
Emile G. McAnany

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### The Authors

**JUAN BRAUN** is Advisor in Evaluation to the Association of Latin American Radio Schools, Buenos Aires, Argentina.

Address: Santa Fe 3110, 1er piso  
Buenos Aires, Argentina

**HENRY CASSIRER** is an international consultant for communication and education.

Address: Les Moulins  
74290 Menthon St. Bernard  
France

**TONY DODDS** is a member of the International Extension College and has worked with the IEC in Tanzania, Mauritius, and Nigeria.

Address: International Extension College  
18 Victoria Park Square  
Bethnal Green  
London, England

**JAMESINE FRIEND** is the on-site Project Manager for the Radio Mathematics Project in Masaya, Nicaragua.

Address: c/o The Institute for Mathematical Studies  
in the Social Sciences  
Stanford University  
Stanford, California 94305  
U.S.A.

**JONATHAN GUNTER** is the Director of the Clearinghouse on Development Communication in Washington, D.C.

Address: Clearinghouse on Development Communication (ICIT)  
The Academy for Educational Development  
1412 22nd St., N.W.  
Washington, D.C. 20037

**BUDD L. HALL** has been involved in the evaluation of several of the Tanzanian radio campaigns and is currently research officer at the International Council for Adult Education.

Address: The International Council for Adult Education  
252 Bloor St., West  
Toronto, Ontario M5S 1V6  
Canada

**HEATHER HUDSON** is a consultant to the Canadian Broadcasting Company.

Address: 64 Marlborough  
Ottawa K1A1E9  
Canada

DEAN T. JAMISON is an economist in the Development Economics Department of the World Bank.

Address: The World Bank  
1818 H St., N.W.  
Washington, D.C. 20433  
U.S.A.

PETER KINYANJUI is the Director of the Institute for Adult Studies at the University of Nairobi.

Address: Institute for Adult Studies  
P.O. Box 30688  
Nairobi, Kenya

OSVALDO KREIMER is Assistant Professor in the School of Public Communication at Boston University.

Address: School of Public Communication  
Boston University  
Boston, Massachusetts 02215  
U.S.A.

JOANNE LESLIE is a graduate student in the Department of International Health, Johns Hopkins University.

Address: 3252 Patterson St., N.W.  
Washington, D.C. 20015  
U.S.A.

BRUCE LUSIGNAN is Director of the Communication Satellite Planning Center and Associate Professor of Electrical Engineering at Stanford University.

Address: Department of Electrical Engineering  
Stanford University  
Stanford, California 94305  
U.S.A.

EMILE McANANY is Assistant Professor of Communications, Institute for Communication Research, Stanford University.

Address: The Institute for Communication Research  
Stanford University  
Stanford, California 94305  
U.S.A.

EDWIN PARKER is Professor of Communications, Institute for Communication Research, Stanford University.

Address: The Institute for Communication Research  
Stanford University  
Stanford, California 94305  
U.S.A.

EVERETT ROGERS is a Professor of Communications, Institute for Communication Research, Stanford University.

Address: The Institute for Communication Research  
Stanford University  
Stanford, California 94305  
U.S.A.

SYLVIA SCHMELKES DE SOTELO is a research director with the Centro de Estudios Educativos, Mexico City.

Address: Centro de Estudios Educativos  
Avenida Revolucion 1291  
Mexico 20, D.F.  
Mexico

BARBARA SEARLE is a Coordinator for the Radio Mathematics Project in Masaya, Nicaragua.

Address: The Institute for Mathematical Studies  
in the Social Sciences  
Stanford University  
Stanford, California 94305  
U.S.A.

PETER L. SPAIN is Research Associate, Institute for Communication Research, Stanford University.

Address: The Institute for Communication Research  
Stanford University  
Stanford, California 94305  
U.S.A.

PATRICK SUPPES is Professor of Philosophy, Professor of Psychology, Professor of Statistics, and Director, Institute for Mathematical Studies in the Social Sciences, Stanford University.

Address: The Institute for Mathematical Studies  
in the Social Sciences  
Stanford University  
Stanford, California 94305  
U.S.A.

JAMES THEROUX is directing research on radio software at the University of Massachusetts.

Address: Nonformal Education Center  
University of Massachusetts  
Hills House South  
Amherst, Massachusetts 01002  
U.S.A.

MARK VERMILION is Research Assistant, Institute for Communication Research, Stanford University.

Address: The Institute for Communication Research  
Stanford University  
Stanford, California 94305  
U.S.A.

ROBERT A. WHITE is a member of the Instituto de Investigaciones Socio-economicas, Tegucigalpa, Honduras.

Address: Instituto de Investigaciones Socio-economicas  
Apartado 786  
Tegucigalpa, Honduras

## CHAPTER I

### THE NICARAGUA RADIO MATHEMATICS PROJECT\*

Barbara Searle, Patrick Suppes, and Jamesine Friend

#### SUMMARY

This project was undertaken under contract with the Agency for International Development by the Institute for Mathematical Studies in the Social Sciences at Stanford University, beginning in July 1973, in an attempt to fill the need for studies of radio projects that rely primarily upon radio presentations to teach a curriculum. Nicaragua was selected as a suitable project site because it had no existing radio instruction program, the students are taught in their native language, and the government was willing to support the project with local staff and facilities.

The research aims of the project were to develop and test a mathematics curriculum dependent upon radio presentations and using teacher-directed activities as a supplement to the radio lessons. Because the mathematics curriculum of the Nicaraguan Ministry of Education was adequate and closely resembled those of other developing countries, its contents were used to develop the radio lessons. The content of the lessons was broken into strands, topic areas that represented the major skills to be taught. These strands were further broken into lessons segments, from which individual lessons were developed and translated into 20-minute radio scripts. Student worksheets and teachers' guides supplemented this.

The research activities of the project were closely related to the phases of lesson development. In Phase A, the research was formative, directed toward lesson improvement and limited to a small number of classrooms; in Phase B, the number of classrooms was expanded and a control group was included, changing the emphasis to a more summative one of comparative assessment of achievement levels between the experimental and control groups.

It was found that the greater the demand for active student response in the radio lessons, the more effective these lessons were. Consequently, the format of the lessons gradually changed to a faster-paced active response style that demanded oral, physical, and written responses from the students. The skills taught were reinforced by mixed drills, so that the topics introduced reappeared subsequently in frequent, short practice sessions throughout the school year.

In general, the radio instruction project was well received by both teachers and students. Looking at the worksheets, it is clear that

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\* This work is supported by the Education and Human Resources Division within the Technical Assistance Bureau of the United States Agency for International Development.



students were getting a great deal of practice and were responding with correct answers. Student performance was measured by a pre- and post-test. The experimental group performed well, and sometimes substantially above the control group. A full-scale summative evaluation is planned in 1976 to more thoroughly substantiate these results.

Efforts are being made to decrease the cost of the instructional program so that it can be used in situations where the lack of financial resources is the main barrier to providing effective primary school education.

## INTRODUCTION

Among the various technologies of instruction now being used around the world, ranging from programmed instruction booklets to color television and computers, radio emerges as one of the most economical. Although radio instruction has been used in various parts of the world for over 40 years, it has been little studied. In a recent survey of experimental and empirical studies of the effectiveness of teaching by radio, Jamison, Suppes and Wells (1974) found few in which radio carried the major burden of instruction, and none that examined the relation of curriculum structure to student achievement.

The study reported here, now in the early stages of implementation, uses radio to teach mathematics to primary-grade school children in Nicaragua. Extensive collection of student response data and a precisely defined model for curriculum development make possible the type of radio instruction that has heretofore been absent from the research literature.

In July, 1973, the Agency for International Development (AID) contracted with the Institute for Mathematical Studies in the Social Sciences at Stanford University to carry out a two-stage project. During the first stage, which occupied the first funding year, we visited developing countries whose governments expressed an interest in teaching mathematics by radio, and selected from among them a suitable project site. During the second stage of the project we are developing and evaluating the radio instruction system.

Nicaragua was selected as the project site from among 12 prospective countries: four in Asia, two in Africa, and six in Latin America. In making the choice, we eliminated from consideration those countries in which primary-grade students are not taught in their native language, and those countries that are already using radio instructional systems, and we gave favorable consideration to countries that agreed to support the project with local facilities and personnel. The site visits and country selection process are described fully in Searle (1974). As

of this writing, the project has completed its first year of operations in Nicaragua. During the school year which began in mid-February and ended in mid-November of 1975 we pilot tested first-grade lessons.

In the first section of this paper we describe the operation of the project, its objectives, and the school setting in which we are working. We then consider the preparation of the radio lessons. A third section describes the research aspects of the project and presents preliminary results. We conclude with an informal assessment of the status of the project today.

## 1. THE PROJECT

### 1.1 The Nature of a Day's Lesson

The Radio Mathematics Project assumes responsibility for all of the mathematics instruction children receive. A daily lesson consists of a 20-minute radio presentation, followed by approximately 20 minutes of teacher-directed activities, for which instructions are contained in a project-developed teachers' guide. No textbooks are used and printed material is limited to a one-page worksheet for each child each day. All instruction, including the radio lesson, is given in Spanish.

During each radio lesson the children are asked to respond orally, physically, and in writing, and they do so 40 to 50 times during each 20-minute lesson. Sometimes children handle concrete materials during the broadcast—for example, counting or grouping small objects. Dialogue between radio characters introduces new mathematical material and children are asked to respond orally. In later lessons, the same exercises are repeated and the children respond individually on their worksheets. After the radio transmission, the teacher continues the lesson, following the directions given in the teacher's guide.

### 1.2 The Objectives of the Project

The development and testing of curriculum materials for each grade level is being carried out in two phases. During Phase A lessons are presented in a small number of classrooms and evaluation efforts are concentrated on improving the quality and effectiveness of lessons. During Phase B lessons are broadcast to a larger number of classrooms, and the evaluation is directed toward a comparison of the effectiveness of the radio instructional system with traditional instruction.

The research aims of the project can be broadly characterized as related to educational achievement, to the economics of radio as a technology of instruction, and to the generalizability of the results to other settings. Among the educational questions of concern are:

Can mathematics be taught effectively using radio as the primary source of instruction? How are achievement gains related to student characteristics? How does achievement of students learning by radio compare with learning in the conventional classroom? How does the instructional program affect student and teacher attitudes towards mathematics, towards school, towards learning by radio? Do attendance and dropout patterns change when radio instruction is introduced in the classroom? Does the number of students failing mathematics change? Does performance in other school subjects change? As we chart the successes and failures of the instructional system we want to search for causes, to investigate how the components of the system are related to its effects.

The economic aspects of the instructional system are of great concern. We want to know: What are the development costs of the program? What are the operational costs? Can the cost of implementing the system in a different setting be estimated? What are the economic consequences of using radio in the classroom? Is the rate of flow of students through the school system, and hence the per-pupil cost of education, affected? What is the cost of each of the components of the system and how is that cost related to its effectiveness? How much teacher training is necessary to maintain an effective level of instruction? How much supplementary material must be prepared for students? How much supervision will teachers need in order to use the radio in the classroom?

Our interest in generalizability requires first that we describe each component of the instructional program and the methods of its design and validation. We will ask: What types of data analysis prove useful during lesson development? Can we identify variables that characterize successful radio lessons? We must also explore in detail our relationship with the Nicaraguan educational system at the Ministry level and at the local school level. Have we successfully established the project as an integral part of the educational establishment? Have we successfully trained counterparts for Stanford personnel? Is operation of the project included in the Ministry budget? What kind of reception has the project received? How do local supervisors and teachers view the use of radio in the classroom? And finally, how should the project document the organizational requirements for implementation so that another group can put the instructional materials to use in a different setting?

We should also mention some interesting and important questions that our research effort is not designed to answer. We do not intend to investigate ways of changing the mathematics curriculum; rather, we see our task as implementing the established guidelines using teaching methods specifically designed for radio. There is currently great interest in the developing world in designing curriculums that meet the needs of local populations, especially in the rural areas. We feel that attention to the needs of the rural population would not produce a mathematics curriculum that is fundamentally different from the one in use in Nicaragua today.

There is also great interest, in the United States as well as elsewhere in the world, in designing instructional systems that make use of a variety of media. The challenge is to select from among TV, radio, films, modules of programmed instruction, individual cassettes, games, manipulative materials, books, and other types of media, the optimal mix for helping students meet the objectives of an instructional unit. Our examination of such possibilities suggests that we will lose little by restricting ourselves to a limited use of printed and display materials in conjunction with the regularly scheduled daily broadcast lesson. The main thrust of any systematic variations of media auxiliary to the radio lessons will be towards the reduction of costs.

### 1.3 Site of Project Activities

The project is located in the Department of Masaya, which is approximately 30 kilometers southeast of Managua. The Department has an area of about 543 square kilometers, and is the smallest of the 16 departments in the country. The population is about 94,000 and approximately 30,000 people live in the city of Masaya, capital of the Department.

Information about the characteristics of schools is given in the next two tables. Data for 1971 on the number of schools and classes in Masaya are presented in Table 1. Urban schools are, on the average, larger than rural schools. More than half of the rural classrooms have more than one grade being taught simultaneously, while this is true of about only 15 percent of the urban classrooms. The number of pupils at each grade level in 1971, for urban and rural students, is shown in Table 2. The school population declines with grade far more sharply in rural than in urban areas. For urban schools, the sixth-grade population is 27 percent of the first-grade population, while for rural schools the comparable figure is 9 percent.

A question of some interest is how typical the schools of Masaya are of the country as a whole. The department of Masaya is compared with the whole of Nicaragua for several indices in Table 3. Although Masaya teachers seem to be somewhat better trained (probably a reflection of the proximity to Managua) and a higher percentage of rural Masaya children attend school, the department is, in most respects noted in the table, typical of the country.

Almost all classrooms in the department have a chair and a writing surface for each child and at least one blackboard, but few other teaching materials. Attendance ranges roughly from 20 to 50 (although some classes have as many as 60 or 70 students matriculated).



TABLE 1

Number of Schools and Classes  
in Masaya in 1971

| Location | Number of<br>schools | Number of<br>classes |
|----------|----------------------|----------------------|
| Urban    | 51                   | 245                  |
| Rural    | 66                   | 118                  |
| Total    | 117                  | 363                  |



TABLE 2

Distribution of Pupils by Grades  
Department of Masaya, 1971.

| Grade | Urban Pupils | Rural Pupils | Total Number of Pupils |
|-------|--------------|--------------|------------------------|
| 1     | 4,357        | 2,825        | 7,182                  |
| 2     | 2,502        | 1,256        | 3,758                  |
| 3     | 2,201        | 832          | 3,033                  |
| 4     | 1,741        | 550          | 2,291                  |
| 5     | 1,338        | 359          | 1,697                  |
| 6     | 1,172        | 258          | 1,430                  |
| Total | 13,311       | 6,080        | 19,391                 |

TABLE 3

Comparison of Educational Statistics  
in Masaya and Nicaragua

| Index                                   | Masaya | Nicaragua |
|-----------------------------------------|--------|-----------|
| Percentage of rural children in school  | 83     | 68        |
| Percentage of certified teachers        | 94     | 79        |
| Percentage of classrooms with:          |        |           |
| one grade                               | 84     | 79        |
| two grades                              | 5      | 5         |
| more than two grades                    | 11     | 16        |
| Pupil-teacher ratio                     | 35     | 38        |
| Percentage of school children in:       |        |           |
| Preprimary                              | .8     | 2.7       |
| Grade 1                                 | 36.7   | 36.6      |
| Grade 2                                 | 19.2   | 19.0      |
| Grade 3                                 | 15.0   | 14.9      |
| Grade 4                                 | 11.2   | 11.5      |
| Grade 5                                 | 9.5    | 8.6       |
| Grade 6                                 | 7.6    | 6.7       |
| Percentage of illiterate adults (1970): |        |           |
| Urban                                   | 21.1   | 16.6      |
| Rural                                   | 57.0   | 62.5      |

Note. Data are for 1971 unless otherwise noted.

In many mathematics classes we observed that teachers group students by ability, forming from two to four groups and providing each group with different instruction. It was our impression that teachers spent more time with the more able students. Certainly the range in instructional content was wide--in several classrooms observed during the second half of first grade some students were working on basic number concepts (copying one-digit numbers and counting from one to ten) while others were working on multiplication and division exercises.

In view of the wide range of topics taught in first-grade mathematics classes we felt it imperative to obtain measures of achievement of students in traditional classrooms. Nicaragua does not use a nationwide testing program (although one is currently being considered). Therefore, the project staff developed a test designed to measure attainment of curricular objectives of the Nicaraguan mathematics program. We found that, in general, achievement levels for traditional first-grade topics were quite low--most items were answered correctly by fewer than half the children. Although teachers were teaching multiplication, division, and operations with fractions, students were not learning these topics.

The design of the test also allowed a comparison of performance levels of children from urban, municipal, and rural schools. Much to our surprise, test scores for urban, municipal, and rural children were not significantly different (mean estimated scores were, respectively, 37.2, 36.4, 34.2). This finding must be confirmed by further testing. Of the possible explanations, we were able to test one--the effect of age. Mean ages for urban students (8.2 years) and for rural students (8.5 years), are not significantly different. The proportion of children attending school may be lower for rural children, resulting in a more highly selected population, although we have no data to support this hypothesis. Alternatively, the urban environment of the Department of Masaya may not be sufficiently different from the rural environment to produce the differences typically found.

## 2. PREPARATION OF THE RADIO LESSONS

### 2.1 Implementing Psychological Principles of Instruction

A fundamental question facing designers of radio instruction is: How can we implement principles of good teaching using radio as the instructional medium? A list of such principles includes the following:

Instruction is more effective when children respond actively.

Reinforcement--knowledge of results--increases rate of learning.

Children's thinking progresses from the concrete to the abstract, and therefore practice with concrete materials facilitates learning.

Practice is more effective when distributed over many sessions rather than concentrated in fewer, longer sessions.

Children learn at different rates, and instruction for each child should be tailored to his learning rate.

A good teacher uses these principles as he makes decisions about organizing classroom activities, preparing lesson outlines, and even about arranging the furniture in the classroom. We are attempting to use these principles as guidelines for determining the structure and content of radio lessons.

Active responding. Experimental evidence that active responding improves learning of young children is to be found in Suppes and Ginsberg (1962), which is contrary to evidence that active responses do not strongly influence the behavior of adults (Burke, Estes, and Hellyer, 1954).

We distinguish at least three types of responses that we ask of children. They may speak aloud, they may write, or they may respond physically. We will discuss each of the three response types in turn.

Characters in a radio program may talk either among themselves or directly to the listeners. We make a careful distinction between these two modes. When characters are talking to each other, we expect children to listen without responding. When a character talks directly to the children, we expect and plan for the children to respond. In this way a type of dialogue can be established between a radio character and the children. Student responses are highly structured, and there is, of course, no complex interaction; nevertheless the process engages the attention of the children.

Oral responses include such 'conversations' between the children and radio characters, and also answers to exercises presented in both free-response format and multiple-choice format. An example of an oral exercise in multiple-choice format is:

I am thinking of two objects--a box and a ball. Which is round?

An oral exercise in free-response format, presented abstractly, is

What is 5 plus 10?

and presented in story form,

Juan earned 5 centavos yesterday and 10 centavos today.  
How much did he earn altogether?

Recitation--rote counting, reciting the days of the week or months of the year--is also used. As another type of oral response, children sing songs. A song is taught by having radio characters sing it several times at its first presentation and then at least once in each of several successive lessons. After only a few repetitions the children are able to join the singing. Many of the songs we use are about mathematics. Lyrics are written by the project staff and set to music and recorded by Nicaraguan musicians.

Physical activity is a second kind of response (nonverbal) that the radio characters ask of the children. Children may play games--one game has them patting their knees, their shoulders and their cheeks a specified number of times--or they may be asked to hold up fingers, handle materials, or point to pictures or numbers on the worksheet.

Finally, the children are asked to write on the worksheet. Once again, exercises are presented either in multiple-choice or in free-response format. In the former, children mark the correct choice, while in the latter they may draw pictures or write numerals or words.

We are experimenting to find an appropriate level of activity for the children. Our present lessons are much faster paced and ask for more responses than the initial lessons we pilot-tested. At present the lessons ask for an average of two to three responses per minute, and our classroom observations suggest that this rate of responding could be increased. The children appear inattentive while radio characters talk to each other, but as soon as a character adopts the tone of voice used to talk to the children they become attentive.

Maintaining children's attention is, of course, a necessary pre-requisite for effective radio lessons. Our initial view was that we would use stories to engage the children, and embed mathematical work in a story context to maintain interest. Pilot tests of lessons designed in this way, using kindergarten and first-grade children in California and first-grade children in Nicaragua, have convinced us that the mathematical activities are intrinsically interesting to the children and do not need story support, as long as the children are asked to respond frequently. Thus, our view of the role and importance of stories has changed markedly.



Reinforcement. Providing children with knowledge of results has been shown to facilitate learning in many settings (Stolurow, 1961). Similar results have been obtained for adults in highly controlled experimental situations by Bower (1962) and others. We have experimented with various methods of reinforcement. In a pilot test of five recorded lessons, using California kindergarten and first-grade children, we found that few children changed their written answers, or even appeared to listen, when the radio lesson provided a correct answer several seconds after an exercise was presented. We found first-grade children familiar with the procedure for checking a group of written answers, but this procedure gives no reinforcement with oral exercises, because the children do not remember what the exercise was.

To date, the most successful method we have found for providing knowledge of results is to ask the children to respond orally. In this way, children who do not know the correct answer learn from those who do. This method can be used in conjunction with written exercises by first asking the children to write their answers, then to say them aloud.

Concrete materials. There is almost universal agreement today that lower primary-level students should use concrete materials while studying mathematics. However, there are many obstacles to the use of materials during radio lessons. Although the best Nicaraguan teachers use materials, the practice is limited, and therefore unfamiliar to many teachers. Nicaraguan schools have no money available for the purchase of materials, nor any central method for distributing even those that might be obtained free. Thus, each teacher is individually responsible for their provision.

Problems of an entirely different sort arise when children are asked to handle materials. The objects are dropped, misplaced, argued over, even thrown around the room. The fast pacing of the radio lessons does not allow time for coping with such problems. Even more serious problems arise when the teacher has failed to distribute the materials, or has handed out the wrong number, and the children are unable to follow the directions given by the radio. However, we have been able to make some use of concrete materials during the radio lessons, and are continuing our experimentation in this area. We make more extensive use of materials in the post-broadcast portion of the lesson.

Mixed drills. The research literature on the effect of practice on learning, supports the proposition that skills need to be practiced regularly to be maintained, and that distributed practice is superior to massed practice (Underwood, 1961). Thus, a specified amount of practice is more valuable when it occurs in short, frequent sessions than in longer, less frequent sessions. In a classic paper that summarized 48 unpublished studies, Wilson (1925) concluded that drill should have the following attributes in order to be effective:

1. It should be on the entire process.
2. It should come frequently in small amounts.
3. Each unit should be a mixed drill.
4. It should have a time limit.
5. Examples in a unit drill should be in order of difficulty.
6. It should include verbal problems.
7. It should facilitate diagnosis.

With these experimental results in mind, we have developed a lesson structure that provides for several different topics in each lesson, as well as different types of activities and different modes of responding. (The structure of the lessons is described more fully in a later section.) Once a topic has been introduced, it reappears at regular intervals, sometimes in the same, sometimes in different contexts, providing continuing practice for the children.

Differential learning rates. Coping with differential learning rates is the most difficult problem facing the developer of curriculum for radio. During the first experimental year we were concerned primarily with exploring the extent of the problem. How large is the spread in achievement at the beginning of the year, and as the school year progresses? Do children who are performing very well or very poorly appear to lose interest in lessons? We will rely on classroom observers, teachers' reports, and weekly tests to answer these questions.

We have given some thought to ways of providing different levels of instruction to different children during broadcasting. In our testing program we developed exercises that had different printed materials associated with a single set of oral instructions, allowing children who were listening to a common set of instructions to work different exercises. Primary experimentation with this method indicates that it holds promise for allowing children to practice skills at different levels of difficulty. Providing post-broadcast materials for children of different ability levels would also contribute to differentiating instruction.

## 2.2 Curriculum Structure and Lesson Production

Project lessons are based on the mathematics curriculum specified by the Nicaraguan Ministry of Education. A thorough revision of the primary mathematics curriculum was completed in 1973, under the

direction of Mrs. Vitalia Vrooman, who is now Nicaraguan Director of the project. An abbreviated version of the new curriculum outline for First Grade appears in Figure 1. The list of topics is that of a typical 'modern mathematics' program. Except for the inclusion of formal work on multiplication and division, the outline closely resembles those prepared in the United States. It is also very similar to outlines we have examined from other developing countries, an illustration of the great commonality in primary school mathematics curriculums throughout the world.

There are several reasons for adopting the Nicaraguan curriculum as the basis for project lessons. First, the curriculum is certainly satisfactory as a basis for the radio lessons. Second, the Ministry has expended much effort in the last several years revising the curriculum and retraining teachers. We feel that teachers will be less resistant to a change in mode of presentation of lessons if the curriculum is not changed (once again) at the same time. Finally, the use of the same curriculum in experimental and control classes facilitates evaluation of the radio lessons.

Some changes in emphasis and some reorganization of the Nicaraguan curriculum have proved necessary in structuring the radio lessons. As shown in Figure 1, each topic in the Nicaraguan curriculum is allotted a specific period for instruction. Teachers customarily follow these guidelines, presenting all instruction on a topic in a single block of time. Because of the demonstrated superiority of distributed practice we chose not to follow this procedure, instead dispersing instruction on each topic throughout the school year.

The process of designing radio lessons from the rather general specifications of the Ministry of Education curriculum guide involves several steps. These are the steps, as we conceive them:

1. The curriculum specialist, in consultation with local experts, specifies the general content of the curriculum, and then divides the curriculum into small units that can serve as a basis for lesson design.
2. The curriculum specialist designs an individual lesson.
3. The script writer translates the specifications for the lesson into a radio script.
4. To produce the lesson,
  - a. the artist prepares the worksheet,
  - b. a teacher training expert prepares the teacher's guide, and

- First Unit:** Basic Concepts (2 weeks)  
size, height, position, width, quantity, weight
- Second Unit:** Sets (4 weeks)  
set, element, comparing sets, equality, inequality
- Third Unit:** Systems of Counting (8 weeks)  
counting up to 99, ordinals, place value
- Fourth Unit:** Addition and Subtraction (4 weeks)  
  
addition and subtraction as inverse operations, sums, differences to 18, addition and subtraction of 2-digit numbers without carrying or borrowing
- Fifth Unit:** Multiplication and Division (3 weeks)  
  
Readiness work, multiplication combinations up to 27, division with dividends up to 15, divisors of 2 to 5
- Sixth Unit:** Common Fractions (2 weeks)  
  
halves, thirds, and fourths
- Seventh Unit:** Money (2 weeks)  
  
monetary unit--el cordoba, 5, 10, 25, 50 centavo coins, equivalencies
- Eighth Unit:** Measures (5 weeks)  
  
length, volume, time, weight, pairs and dozens
- Ninth Unit:** Geometry  
  
point, line, plane, curved and straight lines, angles, figures with 3, 4, more sides

FIGURE 1. Nicaraguan first grade curriculum: condensed version of outline prepared by the Ministry of Public Education.

- c. the recording artists record the lesson, under the direction of the radio producer.
5. The components of the lesson (worksheets, teachers' guides) are reproduced and distributed to schools.

Between each of these steps the curriculum specialist and the script writer review the work in progress so that the script writer fully understands the instructional intent of the lesson and the final script accurately reflects the original specifications. We will discuss each of these steps as it is implemented by the project in Nicaragua.

Step 1: Preparation of the curriculum. As discussed above, the mathematical content of the radio lessons is that specified by the Nicaraguan curriculum guide. The curriculum specialists have divided that content into topics or strands. For first grade the strands are Basic Concepts, Number Concepts, Addition, Subtraction, Applications, Geometry, and Measurement. For each strand a set of behavioral objectives is formulated, defining the behavior expected of a student who has successfully completed the first-grade instructional program. The objectives specify only what the student should be able to do at the end of the year, and each must be broken down into subobjectives appropriate for instruction. Consider, for example, an objective that states,

The student will count the number of objects in a set of  $N$  objects, where  $N$  is less than or equal to 25.

The first subobjective might restrict the number of objects to five or fewer, a second might use from six to ten objects, and so on. Thus, the next step in curriculum preparation is to subdivide each objective into a series of subobjectives, called instructional classes. The instructional classes must then be put in order so that for any given concept or exercise type, all those prerequisite to it come earlier in the instructional sequence.

Figure 2 shows a hypothetical strand that has three terminal objectives, A, B, and C. Objective A has three subobjectives, B has four, and C has two. The subobjectives are used to define instructional classes and these have been arranged in the figure in what might be a typical order. The order of instructional classes within a strand is determined by the curriculum specialist.

In the case of first-grade mathematics, we have good criteria for determining an appropriate ordering of classes. The subject matter itself is hierarchical; in many cases concepts and problem types build logically on one another. Moreover, at the Institute at Stanford we have developed several elementary-level mathematics courses, two of them using computer-assisted instruction. We have collected over the years a large body of performance data, which provides additional guidelines for



## STRUCTURE OF A STRAND

### Objectives

A

B

C

### Subobjectives

1, 2, 3

1, 2, 3, 4

1, 2

### INSTRUCTIONAL ORDER OF SUBOBJECTIVES :

|    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|
| A1 | B1 | A2 | C1 | B2 | B3 | A3 | C2 | B4 |
|----|----|----|----|----|----|----|----|----|

Figure 2. Structure of a strand.

the ordering of subobjectives based on the relative difficulty of exercise types. These results are reported in Suppes (1972, 1974), Suppes and Morningstar (1970), and Suppes, Searle, and Lorton (in press).

Once a set of classes has been ordered to form a strand, the curriculum developer must consider the interconnections between strands. There may be classes in one strand that are prerequisites for classes in another strand. Figure 3 shows this relationship between four strands. In this example, students must receive instruction in the first two Number Concepts classes before they receive instruction in the first Addition class. Similarly, the first Addition class is a prerequisite for the first two Subtraction classes, and so on.

Each strand now consists of a series of classes specifying the material that is to be taught, in units appropriately designed for instruction. For each class of exercises, students must be taught how to perform the task, they must be given opportunities to practice it, and then, later, they need further review. When the instructional sequence for a strand is constructed, each class appears several times, providing for all three activities.

In addition, for any given presentation of a class of exercises we must specify the mode of presentation and the student response mode. An exercise may be embedded within a story or a realistic situation familiar to the children, or it may be presented abstractly, without embellishment. Students may be asked to answer orally or in writing.

Step 2: Design of an individual lesson. A radio lesson is specified by selecting an appropriate group of instructional classes from several strands. Each class defines a lesson segment, and the segment description specifies the exercises, the mode of presentation, and the mode of response required. From four to seven segments are presented by radio, and from three to six by the teacher in the post-broadcast period. For example, Lesson 18 (near the beginning of first grade) has seven radio segments and three post-broadcast segments. The segment descriptions, as they appear in the outline for script writers, are shown in Table 4.

Table 4 illustrates the variety of topics and response modes that may be incorporated in a single lesson. However, as is evident from the outline, topics are not chosen at random, but in relation to one another. Segments 1 and 7 give different types of practice with roughly the same addition combinations. Segment 4 provides practice in writing the numerals needed in Segment 5, and so on. An outline like that shown in Table 4 (with additional information concerning response modes, timing, and worksheet layout) provides the basis from which script writers produce a script for the radio lesson, curriculum writers produce the teachers' guide, and the artist prepares the worksheet.

# STRAND STRUCTURE SHOWING INTERRELATIONSHIPS

## First Grade Mathematics

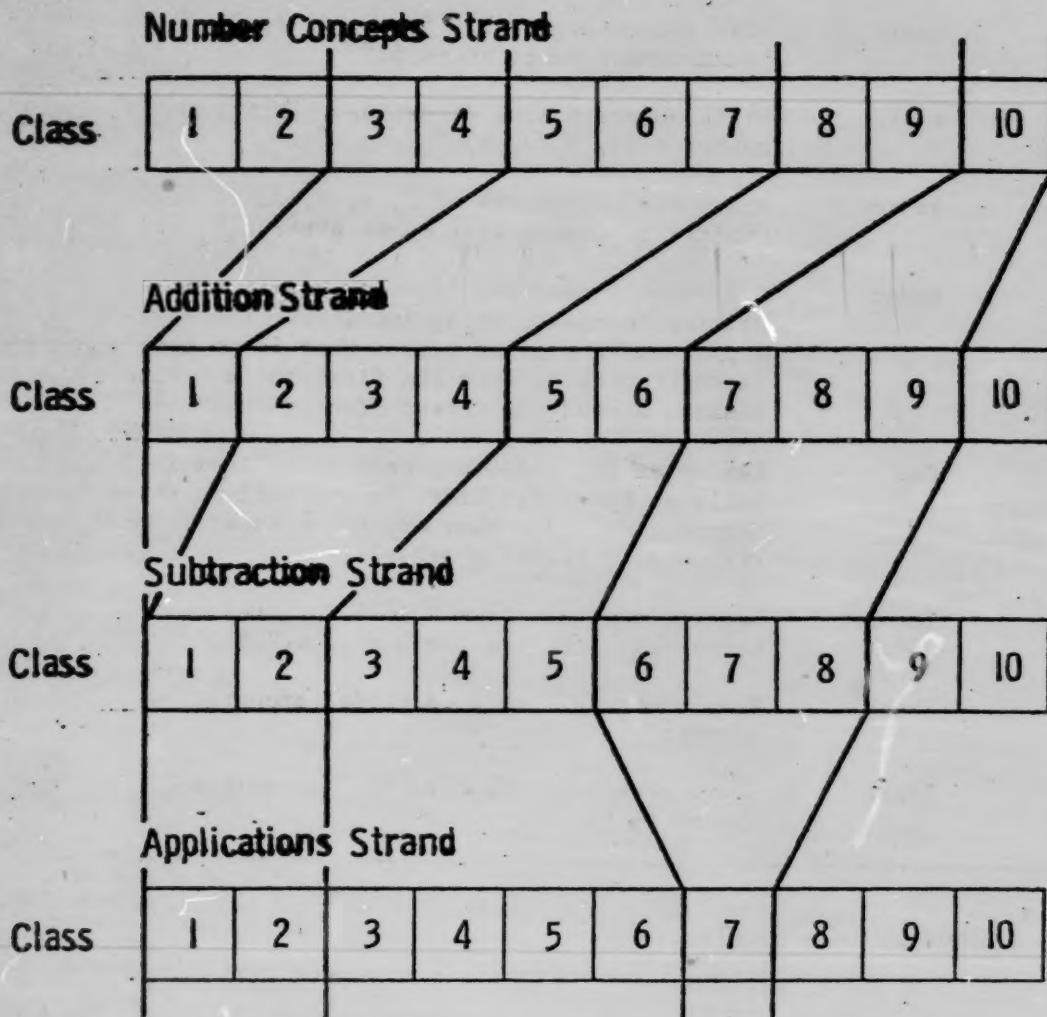


Figure 3. Strand structure showing interrelationships.

Table 4

Segment Descriptions for Lesson 18, Grade One <sup>a</sup>

| Segment number | Presented by | Description                                                                                                                                                                                                    |
|----------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1              | Radio        | Show the addition facts $2+2$ , $3+2$ , $4+1$ , $1+2$ using fingers. "How much is 2 plus 2?"                                                                                                                   |
| 2              | Radio        | Rote count from 1 to 20, two times.                                                                                                                                                                            |
| 3              | Radio        | Give successors orally for 5, 8, 7, 9, 10. "What number comes after 5?"                                                                                                                                        |
| 4              | Radio        | Write numerals from dictation. "Write the number 4 (3, 5, 2, 6)."                                                                                                                                              |
| 5              | Radio        | Write the successors of 2, 1, 4, 3, 1. "Write the number that comes after 2."                                                                                                                                  |
| 6              | Radio        | Ordinals 'first' and 'second', oral, then written response, using drawings. "There is a plate on the first table. What is on the second table? Circle the first table (second basket, second box, first dish). |
| 7              | Radio        | Readiness for addition, drawing. "Draw 2 balls on the first line. Draw 1 ball on the second line. How many are there in all? (oral response) ( $1+2$ , $1+3$ , $3+2$ , $2+2$ )                                 |
| 8              | Teacher      | Reading numerals from 1 to 7 (printed on worksheet). Circle the 3 (6, 2, 4, 7, 5)."                                                                                                                            |
| 9              | Teacher      | Read numerals 1 to 9 on cards (prepared by teacher).                                                                                                                                                           |
| 10             | Teacher      | Count objects, from 1 to 10 (materials chosen by teacher).                                                                                                                                                     |

<sup>a</sup> Translated from Spanish.

Step 3: Translation of lesson specifications into a radio script. Before the lesson outline reaches its final form, the script writer reviews it and makes a preliminary plan for the script. This process often suggests revisions, which the curriculum specialist and the script writer make together. Then the script writer prepares an outline for the projected script and reviews this with the curriculum specialist. No dialogue is written until the two specialists have come to full agreement about the outline.

Although the lesson is initially structured by segments, these are not delineated in the lesson script and the writer is encouraged to embed the mathematics in story contexts in those lessons where stories are used. The placement of songs and games, unless these are included in the outline, is also at the discretion of the script writer. The translation of a segment description into radio script is illustrated in the following excerpt from Lesson 18, (translated from Spanish) which is based on the description for Segment 1 (see Table 4).

The setting is a carnival, with happy background music.

The radio characters--Lulu, Carlos, and Lobo--are laughing and talking excitedly about how many things there are to see and buy. Lobo (a character who often makes mistakes) asks the classroom children to help him count all the things he bought.

Lobo: First I got 2 balloons, then 3 more ...I think 2 plus 3 equals 5.

Carlos: Wait. Let's see if he's right. Attention, children. Hold up two fingers on one hand...and hold up three fingers on the other hand. How many fingers are there? (pause) That's it--2 plus 3 is 5.

And what else did you get, Lobo?

Lobo: I got 2 caramels, and then 2 more.

Carlos: Children, tell me--how much is 2 plus 2? (pause) That's it--4. But let's prove it. Hold up 2 fingers on one hand, and on the other hand hold up 2 more. Now tell me, how many fingers are there? (pause) Very good--2 plus 2 is 4.

Lobo: I also got Roman candles. First I got 3 Roman candles, and then 2 more.



Carlos: Okay, children--how much is 3 plus 2? (pause)  
Now let's prove it with our fingers. Hold  
up 3 fingers on one hand, and hold up 2 on  
the other. How many fingers are there?  
That's right--3 plus 2 is five.

(Carlos does the same thing with  $4 + 1$  (balls)  
and  $1 + 2$  (flags).)

Lobo: Three flags--one for you, Lulu, one for you,  
Carlos, and one for me! Oh, how many things I  
have now!

In asking the children to 'prove' the correctness of their answers, the instructional program is teaching them a method for finding a sum of two numbers that does not depend on memorization.

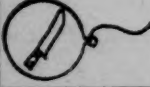
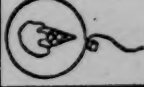
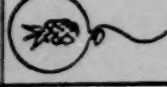
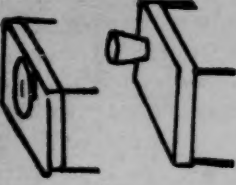
When the first draft of a script is completed, the writer reads it to a group of staff members including those involved with curriculum, teacher training and classroom observation. The listeners use their knowledge of children to comment on the clarity of instructions, the level of difficulty of the language used, and the interest likely to be generated by the stories and characters. The script is then rewritten (if necessary) in response to the criticisms of the staff.

The penultimate version of the script is timed and any necessary adjustments are made. It is then ready for recording. We have found in Nicaragua that an experienced script writer, following the process we have described, can write two or three 20-minute scripts a week.

Step 4: Lesson production. While preparing the lesson outline, the curriculum specialist makes a sketch of the student worksheet that will accompany the lesson. The artist makes a preliminary drawing which is checked for accuracy and clarity, and then is redrawn in final form. Most worksheets use both sides of the paper and, especially for early first grade, contain many illustrations. We employ an artist full time to produce five worksheets a week. The worksheet for Lesson 18 is shown in Figure 4.

A list of suggestions about the contents of the teachers' guide is prepared together with the lesson outline. A curriculum writer uses these to produce a 2 to 3 page guide for each lesson, describing the instructional content and the teacher's role in the postbroadcast activities. Suggestions for optional activities are also included. We find that one writer can write five guides each week, with some time left for visiting classrooms.

Número

|                                                                                   |                                                                                   |                                                                                   |                                                                                     |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |   |
|  |  |  |  |

Nombre

18

|                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |   |  |
|  |  |  |  |  |

Figure 4. Side 1 of worksheet for Lesson 18.

The final step in lesson production takes place in the recording studio. We use professional recording artists, and pre-recorded sound effects and songs, and produce an entire tape in real time. That is, unless some flaw in the tape is found, it is not edited after the recording session. All music and sound effects are taped at the same time as the spoken parts and the timing of pauses for student responses is precisely controlled. We find that an experienced staff--the artists, the producer, and the radio technician--takes about an hour to produce a 20-minute tape.

Step 5: Reproduction of materials and distribution to schools. We use an electronic scanner to make a stencil of the work-sheet prepared by the artist, and all materials are mimeographed at the project office. During the pilot-testing phase materials are delivered to classrooms weekly.

This completes the description of the process of lesson construction, but a few remarks remain to be made. We consider it crucial that every person involved in lesson production observe the use of the lessons in the classroom. Thus we require all writers (of curriculum, scripts, or guides) to visit classes regularly, and encourage visits by other staff members (artists, research staff, even secretaries) as well.

We want to emphasize also that close cooperation and mutual understanding between the curriculum specialist and the script writer is essential for the production of good instructional radio programs. The training of each of these professionals does not predispose them to working well together. The curriculum specialist talks about precisely specifying goals and objectives, while the script writer values intuition and literary creativity. To forge a working relationship between these two takes much skill, understanding, and good will.

### 3. RESEARCH

#### 3.1 Research Objectives

The research activities of the project are closely related to the phases of lesson development. During the initial stages of lesson development (Phase A) research is directed toward lesson improvement; a comparative assessment of achievement levels of experimental and control classes occurs in Phase B. The activities associated with each phase are shown in Table 5. During 1975 the project implemented Phase A for first grade. Sixteen first-grade classrooms, distributed among urban, municipal and rural schools, participated in the pilot-testing of lessons. Some classrooms had only first-grade students while others had students at both first and second grade level. Although all of

TABLE 5

Description of Two Phases  
of Lesson Development

| Category                   | Phase A       | Phase B   |
|----------------------------|---------------|-----------|
| Experimental year          | 1             | 2         |
| Lessons                    | New           | Revised   |
| Presentation mode          | Tape recorder | Radio     |
| Number of<br>classrooms    | About 15      | About 50  |
| Control classes<br>used    | No            | Yes       |
| Character of<br>evaluation | Formative     | Summative |

the teachers participating during the pilot testing phase did so voluntarily. we attempted to enlist teachers with differing levels of experience and competence.

Student worksheets were collected from all sixteen classrooms. In addition, in six classrooms the mathematics lesson was observed daily by project staff members who completed rating sheets covering both general aspects of the lesson and specific questions posed by the lesson developers. This system of observations provided immediate feedback to the curriculum specialists and radio script writers and allowed for much informal experimentation with teaching techniques.

Teacher attitudes about radio instruction and about teaching mathematics were surveyed before their participation in the project, and were resurveyed at the end of the school year. Several teacher training sessions were held before the start of the school year; meetings continued periodically, in response to the needs expressed by teachers and project staff members. The major thrust of the Phase A work was exploratory and developmental.

During 1976, first-grade lessons are being partially revised and broadcast to fifty classrooms. At the same time, initial development and pilot testing of second-grade lessons is proceeding simultaneously, using the same level of observation and data collection as was used for first grade.

For each grade level, the evaluation conducted during Phase A is almost exclusively formative, focusing attention on student attainment of the project's instructional goals. During Phase B, when lessons are delivered to a large number of classrooms by radio, project evaluation efforts are more summative in character. A stratified random sample of classrooms will be assigned to the experimental treatment, with equal numbers selected from urban and rural schools. A random set of control classes, similarly stratified, will also be selected. Both experimental and control classes will be pretested and posttested using mathematics achievement tests. Since the project lessons are based on the mathematics curriculum designed by the Nicaraguan Ministry of Education, both experimental and control classes can be expected to have studied roughly the same material during the school year, allowing for a comparison of mathematics achievement of the two groups.

In addition to comparing achievement, the project will examine performance of students on the school year-end test, and repetition rates due to failure in mathematics. A more broadly based examination of dropout rates is also planned, as a component of an analysis of the economic consequences of the use of radio for classroom instruction.



### 3.2 Preliminary Results

During 1975 the project produced 150 first-grade mathematics lessons that were presented daily in sixteen classrooms in the Department of Masaya, and in an additional six classrooms in the Department of Granada. The Granada classes were added after the start of the school year, and in these classes the project lessons were handled entirely by the local school inspector, so that project personnel had no direct contact with the teachers.

The lessons were well-received by both children and teachers. All of the teachers who participated during 1975 asked to be included in the program during 1976. In general, the children responded well to the fast pacing of the lessons, and participated actively, as we had hoped. Examination of the worksheets indicated that children learned quickly to follow instructions about placing answers on the worksheet. As the year progressed, it was possible to reduce substantially the detailed directions about using worksheets, as children became familiar with procedures. The children were also able to learn to use different types of oral responding taught by the program. The most effective of these was the delayed response; children were asked to think of the answer, but not respond aloud until given the signal (the Spanish word "ya") by the radio.

The children's response to the entertainment portions of the lessons replicated our earlier findings; the most successful activities were songs and physical games, the least successful were stories. The children clearly preferred the mathematical portions of the lessons to the stories.

Data from student worksheets indicated that most students were able to supply correct answers to the worksheet exercises. In many cases, exercises were worked cooperatively, or with the help of the teacher, so that worksheet data did not provide a direct measure of student learning. However, it was clear that most children were getting a great deal of practice, and were responding with correct answers.

For the last third of the school year the project used paper and pencil tests, given separately from the mathematics lesson, to assess student learning. These tests provided information about the level of competency before, during, and after instruction in each of many topics. The use of these tests is being expanded during the 1976 school year, as a tool for monitoring student progress during the school year.

Student performance on the program was assessed by means of a pre-test and a post-test (Searle, Friend, and Suppes, 1976, Chapter 9). For comparison purposes, the tests were given to nine classes not

using the radio programs. As discussed earlier, this first trial of the first-grade radio lessons was designed to provide information for curriculum development; the selection of experimental classes was not random, and therefore, a simple statistical comparison of control and experimental classes is not possible. In general the experimental group performed well; the mean item score (percentage correct) for the experimental group was 67.3 (s.d. = 23.8), while that for the control group was 55.5 (s.d. = 21.4). For 50 of the 88 items, the percentage score for the experimental group was more than 10 points higher than that for the control group. Substantiation of these encouraging results awaits completion of the full-scale summative evaluation planned for 1976; early analyses of the 1976 data suggest that the radio students' results exceeded those of controls by more in 1976 than in 1975.

The experience of the first year suggests the following general conclusions about the design and use of radio lessons.

1. Children are most attentive to radio lessons when they are responding actively.
2. Mathematical activities are more engaging than stories for first-grade children.
3. Children listen to instructions and, in most cases, repetition is not needed.
4. Children can learn new topics from the radio lessons.
5. Teachers are able to incorporate radio lessons into their daily routine.

#### 4. SUMMARY AND CONCLUSION: THE PROJECT TODAY

The experience of the first experimental year of the Radio Mathematics Project is encouraging and fruitful. We have learned that we can successfully teach mathematics by radio to first grade children, and that the program we have designed is acceptable to the Nicaraguan teachers and administrators with whom we are working. We have developed and refined techniques for assuring the active participation of children in the learning process, we have learned how to give clear and unambiguous instructions, and we have developed a curriculum structure that is well suited to radio presentation, and we think can be used with other primary school topics.

Our major concern with the program as it was designed in 1975 is with the cost of implementation. The most serious impediment to the widescale use of the program is the cost of worksheets and the difficulty of distributing them widely. Because of this concern, the project will in turn, in the 1976 second-grade course, to experimenting with lessons without worksheets. Students will use their own notebooks for written work, and most illustrative material will be drawn on the blackboard by teachers. (This method is possible in Nicaragua because the Ministry of Education provides each classroom with a blackboard, and children are required to buy notebooks.) Where necessary, posters will present additional visual material.

We feel that with the experience of the first year behind us we can turn our attention to reducing the cost of the instructional program. We think a program whose major components are recorded lessons and teacher's guides stands a good chance of being implemented in situations where the lack of financial resources is the main barrier to providing effective primary school education.

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## CHAPTER II

### THE RADIO SCHOOLS OF THE TARAHUMARA, MEXICO: AN EVALUATION

Sylvia Schmelkes de Sotelo\*

#### 1. INTRODUCTION

##### 1.1 The Socio-Cultural Context

The Sierra Tarahumara is part of the State of Chihuahua in Northwest Mexico. Constituting an area of 40,000 square kilometers, it is characterized by its broken mountain ranges and severe cold in winter. Besides being one of the most remote areas in Mexico, it suffers from conditions that make agriculture difficult. Nevertheless, it is precisely agriculture that is the principal activity of the inhabitants of the area, who mainly grow corn for their own consumption. They also raise sheep which are not consumed for food but provide an important fertilizer for the land.

The broken mountain ranges and the lack of ways to communicate heighten the considerable dispersion of the population. The few centers of population are the results of the introduction of some basic infrastructure and service activities. The Indian population of the Sierra Tarahumara is even more dispersed than that of other ethnic groups.

The total population of the Sierra Tarahumara was 125,000 in 1960, of which 50,000 were Tarahumara Indians. The difference from other parts of Mexico is that there has been practically no mixing of races here. There are commercial dealings between the Tarahumara and whites, 1/ but the Tarahumara are noted for their isolation, provoked by the immigration of white inhabitants who set themselves up on the best lands that had been occupied by the Tarahumara.

The Tarahumara area, though poor in agriculture, is rich in forests, minerals, and grazing lands. The forests, and until recently the mines, were worked by outside companies that hired local labor. This arrangement lent itself not only to the exploitation of the ejidatario 2/ but a careless destruction of the trees.

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\* This study was prepared by the author and other staff members of the Centro de Estudios Educativos in Mexico City, and was originally published in Spanish (Schmelkes, 1971).

The family is the basic unit of the Tarahumara society. The concept of "town" (pueblo) is another important and meaningful unit of society which reflects the Tarahumara method of governing through councils. The Tarahumara are accustomed to communal work and they offer the Tesguino (a fermented corn drink) in exchange for their collaboration in the planting and harvesting of the corn. Drinking Tesguino is one of the main motives for the meetings of the Tarahumara in addition to being the most important occasion for social interaction, relaxation, and entertainment. 3/

### 1.2 The Jesuit Mission to the Tarahumara

The Jesuit missionaries have been in the Sierra Tarahumara since 1900, after more than a century of exile. The objective of the mission at its inception was defined as "evangelizing and civilizing the Indians". During the first years of missionary effort, the main work was that of spreading the gospel. In 1905, with the hope of combating more effectively "the barbarism, the pagan atmosphere, and the ignorance", the Jesuits set up their first boarding school for children.

"The idea at that time was to give them the best kind of education that their idiosyncrasy, savageness and the actual circumstances would allow for boarding students. Then, after two or three years, we were to cast them out into the vagaries of life with the belief that the lessons learned in our classes and the good habits that we had inculcated would suffice them, as it did our students in the cities, to live as honorable and civilized citizens, but most of all as good and fervent Christians." (Ocampo, 1950, p. 207).

Although there remain the traces of this "salvation" mentality, the effects of the Second Vatican Council, the meeting of the Latin American Bishops at Medellin, and the current social doctrine of the Catholic Church are all obvious among missionaries and are redirecting the Jesuit mission to the Tarahumara, although the exact direction has yet to be determined.

### 1.3 History of the Radio Schools

There was a deeply rooted idea among the missionaries that education was one of the most effective solutions for the backwardness of the Tarahumara people. However, even though the missionaries were able to bring the native population together into concentrations, the educational effort failed. The boarding schools could not hope to cover the educational demand of a population as dispersed as that of the Sierra Tarahumara. It was for this reason that the Radio Schools (referred to as RSs subsequently) were begun in 1955. These were founded on the principle that education would be extended beyond the

boarding schools to reach the larger proportion of the native population. More than that, they would be able to complement the educational effort of the state and federal government and RSs could be created precisely in those areas where there was little possibility of setting up an official school. For this reason, although the RSs had their inspiration from the educational philosophy of Sutatenza Radio in Colombia, unlike their Columbian model, they were directed from the beginning to a young formal school population.

Since the RSs began as an extension of the Jesuit boarding schools, it may be assumed that from the beginning they shared their objective of evangelizing and civilizing the Tarahumara of the Sierra. But more than this, given that they were also founded partly to complement the official educational effort, they would have to offer primary education. In 1957, the Tarahumara RSs gained legal status as a cultural extension of the Iberoamericana University in Mexico City and the permission of the Ministry of Education to teach the first two grades of primary. A short time later they received an informal permission to teach two more grades (to the fourth grade) as an experiment. From the previous point it followed that another objective was to offer the first grades and have them be of such quality that graduates of the RSs who wanted to might continue their studies in regular schools. It was because of this that the educational content was based almost exclusively on the official curriculum, and the free textbooks 4/ were used as the basis for radio programming.

The RSs work as follows: the studio and central transmitter are located in the mission headquarters of Sisoguichi. The classroom radios are tuned solely to the frequency of the Sisoguichi transmitter. Two teachers from a primary normal school teach all of the radio classes. At the time of this study (1971), there were 46 schools with 1,081 students spread out over 10 municipalities in the Sierra. Each school has one or two "auxiliary teacher"--persons who have had no more than primary education themselves. The auxiliary's job is to organize the classes, transmit the information received by radio, supervise, guide, and correct the work of the students. These teachers have received training courses during the summer in Sisoguichi where they learned and practiced teaching methods, and reviewed and deepened their grasp of the subject matter they teach.

In the majority of cases, students from all the grades are in a single classroom. Each subject matter is broadcast during one hour, 15 minutes devoted to each school grade. During the 15 minutes for a particular grade, the pupils of that grade work directly with the radio; in the remaining 45 minutes, they do their individual exercises. In short, while the broadcasts are intended for specific grade levels, the school takes on the characteristics of a non-graded school.

Five of the RSs presently in operation are semi-boarding schools, all located in the Tarahumara areas of the Sierra. These schools were begun in the 1969-70 school year to solve the absentee problem in these areas. Since the population in these areas is quite dispersed, children have great difficulty in getting to classes regularly. These schools act as boarding schools from Monday through Friday. Students are given meals and a place to sleep. This measure tries to make certain that students attend school every day of the week.

With all of this, the objectives, goals, and policies of the RSs have never been made clear. From a beginning that tried to provide an education that was basically directed to the Tarahumara population, the effort has changed, as will be shown, to an education that serves the white population of the Sierra and keeps the Tarahumara in a marginal position.

#### 1.4 The Coming of Change in the Sierra

At present, the Sierra population is experiencing rapid changes. The rugged terrain of the Sierra and the lack of communications have until now held back the increase of government programs. Nevertheless, in mid-1971 the Sierra became the focus of government interest. There is hardly a week that goes by now that news about the Sierra does not appear in the national newspapers. In less than a year, members of the Supreme Council of the Tarahumara have had two visits with President Echeverria of Mexico. 5/ Every day, the number of government projects concerned with the development of the Sierra grows. The National Indian Institute (Instituto Nacional Indigenista) is enlarging its radius of activity. The Administrative Committee for the Federal Program of School Construction (CAPECE) is building seventeen semi-boarding schools to prepare Tarahumara community development workers. The Ministry of Public Works has started the construction of a large network of highways that will cross the Sierra. The National Institute of Rural Community Development (INDECO) is already working on the promotion of tourist ejidos. There is also thought about forest exploitation with large investments of capital. And with all this, extensive programs of hygiene and health are planned. Undoubtedly, the effect of such a program would be to lower infant mortality and increase in a significant way the younger population.

All of the government projects are focused on the "integration of the Tarahumara into national life". As the Estudios Sociales, A.C. (ESAC) clearly pointed out in the conclusions of a socio-economic study on the Sierra Tarahumara: "... this integration means taking part in the consumer economy, in the system of market economy." This presents serious questions: to enter the market in the Sierra means to enter into it in a minority position that carries relationships of even greater dependency on whites. "... this will mean disintegration of the



traditional social system. Cooperation will have to become absorbed in salaried manual labor and consequently social integration will be different. There will be more conflict involving relationships outside rather than within the community and this will create a new type of authority structure." (ESAC, 1971).

From the above, it is clear that an intensive educational effort is needed to prepare the Tarahumara population really to benefit from these changes. Such an education would focus on adults and young adults since these are most in need of immediate preparation to defend the rights of their people. They must participate on an equal footing in the development of their area and not at the same time lose their cultural identity and values. As the study shows below, however, the RSs as they now operate, focus on Tarahumara children in the first few grades and, even with them, results of the schools favor the educational development of their white schoolmates. Even when some Tarahumara children finish the four grades, the result is that either the graduate does not use his education for different kinds of work in his community or he leaves that community, never to return. In short, if the efforts of the RSs are to benefit the intended Tarahumara population in a way that helps genuine integration into national life, then basic changes are called for. It is this important consideration that has inspired the suggested reforms of the RSs outlined below.

## 2. THE EVALUATION OF THE TARAHUMARA RADIO SCHOOLS

### 2.1 Introduction

The lack of clear objectives and of short- and middle- and long-range goals caused the RS authorities to begin to question the apparent progress of this project and to outline the true purpose of the schools. They did not have sufficient information on what had been achieved by the RSs up to the time of the study.

The idea of redefining the goals and objectives of the project had to be based on a better knowledge of the population involved, their aspirations and possibilities, and the effects that the RSs were producing. For these reasons, the authorities of the project asked the Center for Educational Studies (CEE as it will be referred to henceforth) in Mexico City to undertake a thorough study of the problem. The first step was a preliminary visit to the Sierra Tarahumara. The visit resulted in a decision that a first step toward redefining objectives and functions of the RSs would demand more complete information on the people involved in the schools: teachers, students, graduates, and families of students.



## 2.2 Research Design and Methodology

The general and specific objectives that the CEE established for the evaluation were based on the particular interests of the director of the RSs. They were as follows:

### 1. General Objectives:

- a. To undertake a preliminary evaluation of the current efficiency of the RSs; and
- b. To achieve greater understanding of the current system of RSs and to define better the basic problems that affect their operation.

2. Specific objectives: There were specific questions that were posed with each general objectives. These questions reflected the points of greatest interest to the administration of the RSs.

3. Instruments: Instruments appropriate to answer the questions were designed by the CEE staff in Mexico City. They were developed with the goal of getting as much information as possible on each specific question from all of the sectors of the population related to or affected by the RSs. Achievement tests in Spanish and arithmetic were developed for application to students, teachers, and graduates of the schools. 6/

Since the study was exploratory, it seemed preferable to work with less structured survey instruments than with rigidly precoded questionnaires.

4. The sample: The sample of informants was as follows: 24 schools were chosen--more than half the total number. The selection of the schools was made by the study director who took into account criteria of both representatives and accessibility.

A random sample, stratified by grades, of 30 percent of all enrolled students in each school was taken. A 50 percent sample of this students group was subsampled for interviews with parents. Moreover, within the proximity of the school's influence, researchers tried to interview all parents who did not send their children to school or whose children had left school or were thought by teachers to have an unusually high absentee rate.

All teachers and directors of the sample schools were interviewed. Also interviewed were the dropouts that could be found in each community. In addition, interviewers visited 3 government primary schools (complete six grades) where they interviewed graduates of the RSs who were continuing their studies. Unfortunately, the sample of former students could not be representative.

From the experience of pretesting the instruments and from talks with people knowledgeable about the region, the researchers considered it relevant to make a direct observation of the community life of the regions they visited. For this reason, they observed three hours of class in each school and carried a diary where they noted all of the observations made in the community and the interviews with people not included in the sample.

## 2.3 Results of the Study

1. First General Objective - Efficiency of RSs: We will first look briefly at the most significant data on the efficiency of the RSs. Without pretending to do an exhaustive analysis of the results, we think that the data provide a sufficient basis for corroborating the conclusions of the study.

- a. Student Achievement: Although schools were in the eighth month of their school year, students were examined on the previous year's subject matter. For first graders, test had to be developed based on the matter covered up to the time of the testing.

On the assumption that the tests were valid, it is interesting to compare the results of Tarahumara RSs with those of a sample made of Class C private schools in Mexico City that was reported on by Munoz and Guzman (1971).

Fourth grade students of the RSs obtained a mean of 60.1 percent in their final examinations in arithmetic, geometry, and Spanish of the third year material; their counterparts in the Class C schools in Mexico City achieved a mean of 55.1 percent on the same tests. With these comparative data and with the additional information that results were not significantly different in a sample made in the public schools of Mexico City by the National Educational Institute, it is possible to conclude that the Tarahumara RSs are preparing fourth-grade students at approximately the same level as schools in the capital. This indicates that the small proportion of students in the RSs who finish fourth grade are prepared to continue their studies in regular schools.

No multiple correlation or regression analysis was done using achievement scores as the dependent variable. Nevertheless, it is possible to identify the variables that relate to achievement as a result of the cross tabulations and correlations that were done.

Ethnic Group: The makeup of the present ethnic profile of the RSs makes it clear that they serve a racially mixed school population. Similarly, with regard to curriculum, one must keep in mind that teaching is based on the official curriculum, the same as that closely

followed by the radio broadcasts. The broadcasts are in Spanish, despite the fact that the majority of the Tarahumara population speak only their own language. One should recall, too, that the Tarahumara have remained isolated from the whites and so racial division between the two populations is not only a clear social fact but is likely to influence schooling as well.

Taking the student's ethnic group as an independent variable, one finds a significant difference ( $p < .01$ ) in the overall mean achievement (i.e., all tests combined) in favor of white students. The fact that this significant difference appears in the results of the Spanish tests and overall mean achievement but not in the separate arithmetic test, suggests that this is due not to a lesser intellectual capacity of the Tarahumara students but rather to linguistic and cultural factors.

Another datum in support of this hypothesis is that the level of significance in achievement differences between the two groups increases from first to second grade. In contrast to what the data showed, it was expected that this difference would be reduced. The above data suggest that the low achievement of the Tarahumara may be explained more by cultural factors (content that is foreign to both the situation and the people) rather than by factors of ability or intelligence.

A student's ethnic background is clearly a determining factor in his achievement. One may conclude this section by saying that the RSs are largely benefiting the white population, perhaps because of the content and method of education they use.

Although age was tested as a predictor of achievement, no findings of great importance emerged.

Grade: The grade level turned out to be one of the factors that most influenced achievement. If one takes all grades separately, there is a significant correlation ( $p < .05$ ) for achievement in favor of the higher grades. If one dichotomizes the group into first grade and all of the other (second, third, and fourth), one finds a greater significance ( $p < .01$ ), again in favor of the higher grades in the RSs. These data suggest that the first grade is an important initial barrier of selection, basically favoring white students.

Family and background variables: Of a series of family and background variables, only one, mother's education, was found to be significantly related ( $p < .05$ ) to student achievement. 1/

It is surprising that none of the other variables that were considered seemed to have an influence on student learning.

Teacher variables: Three teacher factors were taken as independent variables in the analysis: knowledge of content (based on

their performance on sixth-grade tests) teaching experience, and number of summer teachertraining courses they had attended. 8/

Concerning knowledge of content, teachers had a mean in arithmetic and geometry of 47.9 percent and in Spanish of 75.5 percent on the tests. Since no significant correlation was discovered between teachers' knowledge and student achievement, one may suggest either that the teachers are very homogenous in the knowledge level (but in fact the distribution of scores followed about a normal curve) or that the radio, the official curriculum, or the official textbooks, or perhaps a combination of these three factors, intervenes to level existing differences among them.

A significant relationship ( $p < .05$ ) was found between teaching experience in the RSs and student achievement. Nevertheless, there was no relationship between the number of summer courses teachers had attended and student learning. This last finding may call for an examination of the efficacy of the teacher-training summer courses sponsored by the RS leaders.

In summary, an examination of student achievement shows that the ethnic factor was the predominant one in predicting levels of learning for students in the RSs.

b. Student Dropouts:

Interyear dropout: Unfortunately, it was not possible to collect differential data on failure and dropout rates because information of this kind did not exist at RS headquarters. However, the dropout rates between years for eleven cohorts during the period 1957-1971 demonstrated that interyear dropouts were large, nearly 85 percent.

As a point of comparison it may be worth mentioning that in the cohorts for 1967-1970 from first to fourth grade the national mean for such dropouts for public schools was 50.2 percent and 72.3 percent for rural schools only (Boletín CEE, 1971, and Schmelkes, 1971). Considering these data, the dropout rate for the RSs seems excessive.

On the other hand, the RSs have no set criteria for opening or locating new schools. Consequently, there are a large number of schools that close. In the previous dropout analysis, the number of dropouts due to school closings was examined.

Intrayear Dropout: Lacking data on failure rates, one can only analyze the data on dropouts.

The consistent yearly increase in dropouts perhaps is due to rapid expansion of RSs, beyond the operational and administrative



capacity of the system. Project leaders have only a precarious control over the schools and there is a manifest lack of planning. School supplies run out and are not replaced promptly. Problems that may arise between the teacher and the community can be aggravated without proper intervention.

On the other hand, the fact that dropouts increase steadily in higher grades might be due to the mounting opportunity costs of sending older children to school since they can contribute more to family income. Also one may assume that dropouts are higher among Tarahumara students where the need for a child's help is great. Some indication for this assumption may be seen in the schooling pyramid of both ethnic groups in Table one.

- c. Satisfaction of Demand for Schooling: Given that the samples of parents who do not send their children to school were not random, it is impossible to infer what percentage of all Tarahumara children do not enroll in school. Still the data from interviews with these parents yield interesting indications of why they do not send their children to school. The proportion of children in school to the number of school-age children at home was analyzed. The analysis took this proportion as a dependent variable and found a series of factors that predicted why parents did not send their children to school.

One finds a significant relationship ( $p < .05$ ) between father's education and the dependent variable. The more educated fathers are more likely to send their children to school. However, no such relationship was found for father's occupation or annual income.

Dividing the sample into literate and illiterate fathers, significance of the relationship disappears. One, then, may conclude that more than the fact of being literate or not, it is the number of years in school that is most influential in this case. Table one shows too that ethnic group is an important predictor of whether a parent will send some or all of his children to school. One more variable that seems to influence whether children are sent to school or not is opportunity costs, that is, the help required of children in the mother's or father's work. The relationship of these variables is significant ( $p < .01$ ). There were also a number of other variables that did not predict whether children would be sent to school or not.

In summary, the influential factors here are father's education, ethnic group, and opportunity costs. On the other hand, the fact that father's income and occupation are not predictors seems to mean that school is not perceived as a means of maintaining a certain occupational or economic status but rather as a good in itself: it helps maintain the prestige of a family whose members have had a certain number of years of schooling.



- d. The Role of Formal Education in the Sierra: Before analyzing more carefully the specific role of the RSs, it is worth considering some data on students' parents, both those who are illiterate and those who have part or all of primary education.

The majority of occupations in the Sierra Tarahumara do not demand any use of school learning beyond the most basic elements of literacy. For a majority of these occupations not even literacy is an absolute necessity. This may explain the lack of a significant relationship between father's education and occupation. This seems to mean that things learned in school are not useful in order to change one's occupation or type of work.

Something else happens with annual family income. One finds a significant relationship between schooling and income ( $p < .05$ ), and literacy and income ( $p < .01$ ). If one takes into account that 22 percent of the literates are self-taught and that 46 percent of literates did not go beyond third grade, there are reasons for assuming that what is influencing income is not the number of years in school but literacy or illiteracy.

Schooling and literacy seem to influence income not so much by objective knowledge acquired in school as by a kind of "sixth sense" that must be acquired to keep oneself from being made a fool of in salary or business dealings.

- e. The Role of Formal Education in the RSs: It is important to keep in mind that the RSs primarily give the first four grades of school, following very closely the official curriculum and without adding additional subjects. Based on the analysis of the types of work open to inhabitants of the communities where RSs are located, one would expect that going to these schools would have one of two results: either the graduate leaves his community or he stays to go to work in the same kind of employment his father has where there is no vertical mobility. With or without formal education, occupations in the Sierra Tarahumara do not change from one generation to another.

Clearly, there are other factors that influence the occupation of the graduate than the number of years in school. No one would deny that the RSs might be playing a role in helping individual mobility. What seems clear is that the individual cannot thus succeed within his home community; for him to have occupational mobility, he is forced to leave that community, and thus the community loses its better human resources. The RSs are contributing to this process.

Unfortunately, no data on how many graduates were continuing to study beyond fourth grade were available. Nevertheless, from observation and conversations with community people it is possible to assume

TABLE 1

SCHOOL PYRAMID, BY ETHNIC GROUPS, OF THE SAMPLE

| <u>Grade</u>        | <u>1st</u>    |          | <u>2nd</u>    |          | <u>3rd</u>    |          | <u>4th</u>    |          | <u>Total</u>  |          |
|---------------------|---------------|----------|---------------|----------|---------------|----------|---------------|----------|---------------|----------|
| <u>Ethnic Group</u> | <u>Number</u> | <u>%</u> | <u>Number</u> | <u>%</u> | <u>Number</u> | <u>%</u> | <u>Number</u> | <u>%</u> | <u>Number</u> | <u>%</u> |
| Tarahumaras         | 39            | 73.6     | 10            | 18.9     | 4             | 7.5      | 0             | 0.0      | 53            | 100.00   |
| Mestizos            | 38            | 46.9     | 20            | 24.7     | 11            | 13.6     | 12            | 14.8     | 81            | 100.00   |
| <u>Total</u>        | 77            | 57.4     | 30            | 22.4     | 15            | 11.2     | 12            | 9.0      | 134           | 100.00   |

that the proportion is very small. It is interesting to analyze the factors that influence whether graduates continue their studies or not.

In the first place, there was some relationship between father's education and whether the student dropped out before the end of fourth grade, finished fourth and stopped or continued into fifth. More educated fathers had sons more likely to continue. This suggests that schooling is a means of maintaining the prestige the father has for having gone to school.

Father's occupation is also somewhat related to continuing school. However, the factor most closely associated with continuance in school is father's annual income ( $p < .01$  in favor of higher income). This suggests that if the RSs are providing individual upward mobility, they are providing it for those already more advantaged. This finding replicates a national phenomenon that suggests that education is a monopoly of the relatively better-off students. As a consequence, the RSs seem to be helping to reinforce existing inequalities. One finds additional evidence in the significant relationship ( $p < .05$ ) between a student continuing his studies beyond fourth grade and whether his father is in cash cropping or subsistence agriculture.

One also finds a relationship between age and continuation in studies, in favor of younger students. This means that the opportunity cost of sending a child to school is greater as students grow older. The analysis also shows that the older schools are those that produce more students who continue to study.

In sum, those factors that most influence a student's continuing in school are (in order of importance) family income, cash cropping, father's occupation and education, and age of the student. On the other hand, it seems that the future work of the student, at least in his own community, is not determined by the number of years in school but rather by such family variables as education of father and mother and occupation of the father.

## 2. Second General Objective: Problems of the RSs

The basic problems affecting the operation of the RSs may be briefly summed up as follows:

- a. Lack of objectives, goals, and well-defined policies: The proper operation of an institution requires a clear statement of general objectives and short- and long-range goals. A statement of this kind allows evaluation of the institutional activities in terms of fulfilling or not its stated goals and periodically correcting and modifying these

activities. In the case of an educational institution, the statement of these objectives and goals should be based on the specification of the educational needs of the region or locality where it hopes to work (Munoz, 1968).

As was pointed out previously, the RSs have not had since their beginning a clear statement of objectives and goals or a broad understanding of the educational needs of the region. This has provoked a series of problems that will be discussed below.

- b. Lack of cultural homogeneity among students: Without specifying objectives and goals for the target audience and above all the changes they wished to bring about in it, the RSs currently find themselves at the service of a heterogeneous population in which the pressures of the dominant groups are obviously felt most keenly. Moreover, it is likely that their work in the area of changes in cultural relations would be very limited and, in fact, even counterproductive. All of this undoubtedly affects the proper functioning of the RSs because it means a low attendance rate at schools in the Tarahumara zones, or what is the same, a high level of unsatisfied educational demand; it also affects retention and achievement, both low for Tarahumara students.
- c. Lack of a common motivation among auxiliary teachers: The individual motivations for being teachers (e.g., to make money, thank the missionaries for the education they have been given, work for a while before getting married, etc.) seem to have priority over the objectives of the institution which they work for. These institutional objectives are admittedly very vague and have not been concretized in such a way as to help define the role of the auxiliary teacher himself. The expected behavior of the auxiliary teacher touches on such a wide range of activities that they cannot be evaluated and they vary from community to community.
- d. Lack of a curriculum adapted to the local situation: One fundamental weakness of the RSs is that when they were first being organized, the socio-economic and job market structure was not taken into account. And thus there was a basic lack of correspondence between RSs' education and the needs of the area.

In the environment of the Sierra Tarahumara, the individual most needs basic knowledge of reading, writing, arithmetic, agrarian



law, elements of social organization and above all, an ability to understand his situation in order to be able to defend himself against exploitation from those with whom he has commercial dealings; be they of salaried work or of merchandise or of property. In the isolated situation in which the Tarahumara live, it is even more necessary to offer a training that will help them to a greater self-sufficiency--whether individual or community--in order to satisfy their basic needs of food, clothing, and shelter. Above all, they need an education that will train them to be able in the most favorable way possible to face technological, economic, and, consequently, cultural and social change that will come. It profits them very little to know history, geography, or standard grammar (things that take at least 30% of radio broadcast time) if they cannot understand themselves within their own context and become self-reliant in their organization and action. Since the RSs do not establish the necessary relationship between the school and the socio-economic structure of the community, they are unlikely to succeed in defining the change that they wish to bring about through radio instruction.

The only thing that apparently justified the effort that was put into the RSs was the contribution they made to overcoming the permanent backwardness of the inhabitant of the Sierra. The lack of other, more specific objectives, derived from the real socio-economic conditions of the Sierra inhabitants, has kept attention from more essential aspects and has hindered evaluation of the schools.

The teaching of fundamental knowledge in school takes too long because it is mixed with things that are of little importance to the satisfaction of the necessities spoken of above. Moreover the tool for literacy was the official textbook whose content seems to have been prepared with urban students in mind, to the neglect of the rural situation and the specific necessities of those who live there (Myers, 1965). The result is that the graduates of these schools either continue to live in their community and carry on the same work as their fathers, or else leave their community to secure work in larger cities where some of them continue to study. In this way, the school either contributes to the flight of some of the community's best human resources, or, at least, deprives parents of the help of their children for a minimum of four years. All this in order to make students literate and, in some cases, to teach them Spanish. In short, the formal school curriculum is only useful for those graduates who continue their studies.

This creates a serious problem concerning the function of RSs. Since the content taught in these schools is not adapted to the felt and real needs of the community, the consequence is that the community generally sees the school as having a vague utility, as useful in itself, but with few practical results other than learning to read, write, and figure. The result is that, with few parents willing to forego their child's labor completely, the child has a poor attendance



record in school. Student attendance goes down most during the months of farm work. In sum, the index of potential demand satisfaction is low even for those areas where the schools operate.

- e. Lack of local participation in founding and operating the schools: The problem of irrelevant content of the RSs is both a cause and a consequence for the failure of local participation in building and operating the schools. This creates such problems as failure to see the usefulness of schooling.

The facts that real and felt community needs are not touched upon by the curriculum and that schools have no other function in the community except to hold classes, reinforce the lack of perceived usefulness of the school. Moreover, there are no mechanisms by which the community can express its opinion about the school, the teachers, etc; and this creates a gap between community and school.

This was clearly seen in the responses of parents and students to questions about job and educational aspirations. From these it may be inferred that for the great majority of the people the four grades of formal primary schooling are unnecessary. Rather what is needed is a type of education giving basic information and preparing students for actual or potential jobs in the surrounding community where the RSs operate.

Since there are no criteria for opening schools and little local participation in organizing and running them, it is not surprising that a large number have closed after starting up because of lack of enrollment or discontent of the community or difficulties between teachers and the community, etc. This represents a considerable loss of invested capital for the RS organization.

It seems that the implicit criterion that has predominated in the spread of the RSs has been to prefer quantity, whether in the number of grades and school supplies or in schools and students. The RSs multiplied indiscriminately to the point of lowering their operational and administrative capacity. This has been evident in the lack of adequate attention to the schools and in the constant lowering of the quality of instruction. This later has been reflected chiefly in the following aspects:

- f. Lack of proper supervision and evaluation: The RSs do not have sufficient staff to assure supervision of all schools and an evaluation of their operation even once a year. There are complaints about lack of teaching materials or about radios that have broken that cannot be fixed immediately by the

central headquarters. Some schools go along for a whole year or more with a broken radio and/or without enough necessary school supplies. The central administration, moreover, lacks a good system for feedback, for filing and making summaries of data. This shows up in the failure by RSs to have had satisfactory, periodic evaluations of their results during the 15 years of their operation.

- g. Finance Problems: The stable income of the RSs does not meet even half of the annual operating costs, without including costs of expanding or improving maintenance of the system. This has made it difficult to keep schools in steady operation or to make middle- and long-range plans. The expansion of the RSs has not been systematic but rather has been subject to external circumstances so that schools have been expanded only when extra money became available. Generally, they cannot count on fixed capital for extraordinary expenditures. In short, the schools have grown in such a way that they surpassed the financial capacity of the system. This means low salaries for teachers and encourages their seeking other work.

Unfortunately, the RS administration does not have an estimate of expenses. In Table two there is an approximation of costs based in part on data obtained from the central administration and in part on personal estimates.

- h. Personnel Problems: As a consequence of over-reaching the operational capacity of the system, the present personnel are not sufficient. Also, the majority of personnel who work at headquarters have a number of different jobs, sometimes having nothing to do with the RSs. This, of course, distracts attention from the schools.

There is no one at headquarters or the studio who is specialized in educational radio, mass media, or rural radio. This may help explain the lack of adaptation of the curriculum to the characteristics of the medium of radio and the poor quality of the programs. The director of the project can only partially fulfill his administrative duties because he has to leave frequently in order to seek funds to cover the monthly deficit.

The auxiliary teachers, moreover, do not have sufficient training to carry on an active class or to direct group work. In some

cases, teachers only speak Spanish. In most cases, teachers lack sufficient motivation to give a spark to their teaching and to solve daily classroom problems.

1. The problems of radio: The radio in the RSs is not used to take advantage of its potential to the maximum. Moreover, the data and the observation carried out indicate that student achievement and school efficiency can only in small part be attributed to radio. The following section suggests why this is so.

Only in 7 of the 24 schools that were visited was the radio even operating. There were various reasons. In some cases the set did not receive the signal because of bad weather, or only with such static that it was practically impossible to follow the classes. In the majority of cases the radio was broken and the school was too far from a town or central headquarters to take it to be fixed. In these cases the teachers were waiting for the visit of the supervisor to send it back to headquarters. In some cases the radios were not working simply because the batteries were dead and teachers had not been given replacements. There were also teachers who could not use radio either because they had classes that spoke only Tarahumara while broadcasts were only in Spanish or because students had been absent for some time (generally for farm work) and were too far behind to follow the broadcasts. There are also areas where the radio signal simply does not reach.

One can assume that this situation is representative of what goes on during most of the year. The teachers know that they ought to use the radio and so when the official visits come from headquarters, although they may not use it at other times, they put it on for the visitor. What is more likely, the radio is broken when a visitor comes. The delays in fixing broken radios is a continual problem.

Auxiliary teachers and the normal school teachers who broadcast from the studio in Sisoguichi lack adequate training in the use of radio as an educational tool in the classroom. Broadcasts consist in following the class day by day almost literally from the official textbook. Teachers who follow the radio in the classroom concentrate on directing individual work of the students. The majority of teachers who do not use the broadcasts base their work on the content that they have received in the summer training courses.

One may suppose that at the beginning the auxiliary teacher was really an auxiliary of the educational medium. The radio was thought of as an ideal medium to reach those places where it was more difficult for schools and teachers to be established. The reality, however, is that the teacher is the main person responsible for the class development, and the broadcasts, when they are heard, really

TABLE 2

ESTIMATED ANNUAL COSTS OF THE RADIO SCHOOLS DURING 1969-70  
(in US dollars)

ACCOUNTABLE COSTS

|                                 |                 |
|---------------------------------|-----------------|
| Salaries to auxiliary teachers  | 8,905.38        |
| Salaries to central personnel   | 424.00          |
| Maintenance of boarding schools | 2,392.00        |
| Travel and expenses             | 480.00          |
| School material                 | 460.51          |
| Truck and plane upkeep          | 2,022.80        |
| Freight charges                 | 480.00          |
| Gasoline                        | 961.90          |
| School repair                   | 800.00          |
| Summer courses                  | 904.00          |
| Miscellaneous                   | <u>1,180.87</u> |
| TOTAL                           | 19,011.46       |

ESTIMATED REAL COSTS

Personnel expenses

|                       |               |
|-----------------------|---------------|
| 57 auxiliary teachers | 36,771.84     |
| radio teachers        |               |
| - regulars            | 1,920.00      |
| - substitutes         | 960.00        |
| service personnel     | <u>480.00</u> |

Subtotal

40,131.84

Capital expenses

|                              |                 |
|------------------------------|-----------------|
| land                         | 433.28          |
| housing depreciation         | 7,919.84        |
| furniture depreciation       | 499.84          |
| transmitter depreciation     | 2,666.67        |
| radio depreciation           | 254.40          |
| truck and plane depreciation | <u>3,885.71</u> |

Subtotal

15,659.74

Management expenses

|                        |               |
|------------------------|---------------|
| director's salary      | 4,800.00      |
| administrator's salary | 2,880.00      |
| supervisor's salary    | 1,200.00      |
| technician's salary    | <u>960.00</u> |

Subtotal

9,840.00

Expenses for goods and services

|                        |               |
|------------------------|---------------|
| light                  | 288.00        |
| truck and plane upkeep | 2,022.80      |
| building upkeep        | 800.00        |
| interest payment       | 960.00        |
| fuel                   | 961.90        |
| freight charges        | <u>480.00</u> |

Subtotal

5,512.70

|                         |                 |
|-------------------------|-----------------|
| Other expenses          |                 |
| school material         | 460.55          |
| boarding school support | 2,392.00        |
| travel                  | 480.00          |
| summer courses          | 904.00          |
| miscellaneous           | <u>1,180.87</u> |
| Subtotal                | 5,417.42        |

|             |           |
|-------------|-----------|
| GRAND TOTAL | 95,573.16 |
|-------------|-----------|

|                        |          |
|------------------------|----------|
| Annual total by school | 1,803.27 |
|------------------------|----------|

|                         |        |
|-------------------------|--------|
| Monthly total by school | 150.27 |
|-------------------------|--------|

|                          |       |
|--------------------------|-------|
| Annual total by graduate | 89.99 |
|--------------------------|-------|

|                           |      |
|---------------------------|------|
| Monthly total by graduate | 7.50 |
|---------------------------|------|

|                     |          |
|---------------------|----------|
| Grand monthly total | 7,964.43 |
|---------------------|----------|

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operate as aids to the teacher. Nevertheless, the broadcasts concentrate on presenting basic concepts directly to the students and do not take advantage of the potential of radio as a real aid to the auxiliary teacher. In fact, present broadcast contents are a mixture, in order of importance, of music, direct information to students, direct instructions for students, and, lastly, instructions for the teachers.

One may conclude that the relative failure or success of the RSs as far as academic achievement and social efficiency are concerned cannot be explained by means of the radio but rather by a combination of educational and extracurricular factors that influence these variables among which radio plays a role of secondary importance. Still, radio in the Sierra Tarahumara has a potential not yet exploited which should be taken into account in whatever change or educational innovation is undertaken in the Sierra. 9/

#### 2.4 Conclusions of the Study

Although this study succeeded in collecting enough information to give some answers to the questions raised by the RS administration, the general shortcomings of the system called into question the whole operation so that giving particular suggestions for improvement would not solve problems that affect the RSs, specifically, what students learn, who stays in school, and the relevance of the knowledge acquired in school. The group of general conclusions based on the data which are summarized below demand a rethinking on the part of the administration of the RSs. This should result in a clear definition of objectives, goals, policies, and means, that would give the schools a new direction and permit constant evaluation and re-evaluation. This would have to be done at the first stage by the missionaries themselves and be based on the objective vision of the reality of both the RSs and the Sierra Tarahumara which they serve.

The general conclusions that emerged from the study were as follows:

- The lack of general and specific objectives of the RSs to date have hindered the institution from knowing its successes, failures, and the cost of its efforts.
- The RSs are fulfilling satisfactorily their only explicit objective: to prepare students to want to continue their studies successfully in the regular schools. However, the cost of this result is very high. If one recalls the high rate of interyear dropouts and minimal number of graduates who continue their studies beyond fourth grade, one must conclude that the cost benefit ratio of success in this objective is prohibitively high.

- The very organization of the RSs, the curriculum and method of transmitting it, the objective of preparing students to start fifth grade: all of these have made the education beneficial to those who in relative terms are already in an advantaged position within the ethnic, social, and economic
- The curriculum content that the RSs teach and consequently the schools themselves are not adapted to the situation in which they are operating. The socio-geographical setting of the Sierra does not provide sufficient means to assure the assimilation and recall of the knowledge learned in school. Even if one assumes that the knowledge of basic elements of reading, writing, and figuring were necessary for gaining better means of defending oneself in commercial and labor transactions, there is no justification for having four years of school to get this kind of knowledge. Moreover, this lack of adaptation has promoted a gap between the school and the community.
- The RSs have overloaded their operational, administrative, and financial capacity. The consequences are a high level of mobility of teachers, lack of supervision and attention to the schools and the impossibility of middle- and long-range planning.
- Radio in the RSs has not been used in a way to take advantage of its potential. In part this is due to the lack of trained personnel in all levels and the problems of supervision in the schools. Consequently, radio has only played a secondary part in student achievement and in the internal and external efficiency of the schools.

These conclusions seemed to question the very structure of the Radio Schools. For this reason, it was decided to present these data to the missionaries of the Tarahumara and elaborate more clearly defined objectives, goals, and policies. This would allow a more thorough-going kind of educational planning than was possible before (Schmelkes, 1971).

The missionaries arrived at the conclusion that the RSs had to be restructured from the ground up. For this reason they agreed on the following general objective (Sisoguichi, 1971):

"The general objective of the Radio Schools of the Tarahumara is to promote a liberating, integral, and community education that foments and transmits values and trains for work: all this in a spirit of dialogue.

"By 'liberating and integral education' is understood that the students be made into the subjects of their own development, promoting the struggle against oppression, both structural (socio-economic, political, and cultural) and personal selfishness, in such a way that they can achieve more human conditions of life.

"By 'community education' is meant that which does not promote the spirit of individual competition, but rather promotes the spirit of service and advancement of one's community.

"That foments and transmits value' means that it is the intention of this kind of education to promote values proper to the culture of the students including creative dialogue with other cultures.

"Trains for work' means that one seeks to prepare the students to take advantage of the natural resources necessary for their human development.

"In a spirit of dialogue' means that this kind of education seeks a mutual enrichment of the teacher and the community."

### 3. REFORM OF THE RSs PROPOSED BY THE CEE

Motivated by the objectives elaborated by the missionaries and stated above, the Centro de Estudios Educativos (CEE) developed the following plan for reforming the RSs:

#### 3.1 Objectives

The general statement of objectives elaborated by the Tarahumara missionaries needs to be placed in its context for readers who may not be acquainted with current educational and social philosophy in Latin America. A major influence in many places in Latin America is the thought and practice of Paulo Freire, the Brazilian educator, whose book The Pedagogy of the Oppressed, sums up his views on man and his education/liberation. Beginning with his experiences in Northeast Brazil in the early 1960's, Freire gradually evolved both a view of education and of man, as well as a pedagogical plan of action that is critical of both the oppressive social structures in which many of the poor live and the education that contributes to the maintenance of those structures.

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It is this kind of thinking that guided the plan of reform for the RSs of the Tarahumara. On a general theoretical level, the kinds of

assumptions behind the general objective stated above perhaps should be drawn out before giving the more concrete details of the plan. Otherwise, some of the reasons for the suggestions will not be clear. The basic assumptions of Freire's educational philosophy which would also be included in the CEE plan would include the following:

1. The ontological vocation of man can be defined as to be more, not in an individual way but rather as joined with others.
2. Liberty is a condition of being. Consequently, man is more the more he works for his liberation; that is, the more he works to transform the oppressive situation that surrounds him.
3. Since liberation implies the transformation of concrete reality, it is necessary to know objectively the real oppressive situation and discover its causes.
4. The knowledge of the concrete situation in order to transform it implies a critical consciousness, which is an essential capacity of man; but among the oppressed of Latin America this capacity is found in a latent state. In order to develop this critical consciousness it is necessary that man understands the world not as something already completed, static, but rather as something that can be transformed by the joint action of men. It is also essential that man understands himself as incomplete, capable of transforming himself by means of the transformation of the world.
5. Since man can only liberate himself when joined with others, dialogue is an essential element in every effort at liberation.
- 6.. Education plays an essential role in the process of the liberation of man. Education for the liberation of man is a permanent process. Moreover, it is a process that cannot be prescribed since it is the result of a reality conditioned both by history and social structure. Education is not something done for the student but with him; consequently, the students are the authors of the content of their education.
7. Critical awareness (concientizacion) plays an essential role in the educational process. By means of this process the student is confronted with problems, he is given the clear challenge that is set out both by the world and by the perception of himself. The very action



of man on the world will involve him in problems. It is the permanent process by which men critically perceive their relations with the world. The work of the educator consists of delineating for the oppressed, in the spirit of dialogue, his concrete existential situation as a problem that both challenges him and demands a response from him at the level of action.

In sum, one notes that Freire insists on an education that is tied to an analysis of the student's concrete situation, an education that demands an action on the part of the student to transform that reality in collaboration with others. Such an education is neither teacher-oriented nor content-oriented, nor does it fit the usual formal school model. Its consequences are the liberation of the student from an oppressive social situation and it involves changes in the student's view of himself. Such assumptions may help to explain the concrete suggestions of the following CEE plan for the reform of the RS.

### 3.2 Goals

The goals proposed for the reform of the RSs can be summarized as follows:

1. The population that benefits: The problem of attending to a culturally heterogeneous population is the danger of continuing to benefit those who in one form or another already occupy a higher position in that situation. This suggests that the RSs dedicate their exclusive attention to the Tarahumara, gradually phasing out the work with other populations.
2. The kind of education: In order to avoid the danger of imposing on the population an educational content poorly adapted to the Tarahumara situation, it is proposed that the education given by the RSs be nonformal, flexible, and based on the satisfaction of the real needs of the communities.
3. The sector that benefits: Given that the desired education implies a transformation of the situation of oppression and given that those best able to take decisions in this respect are the adolescents and adults, it is recommended that the RSs principally serve this age group and that indirectly through this means they bring about a more effective and permanent education of younger students.
4. Content of education: Education would follow three basic lines of development: fundamental education



(critical awareness, literacy, arithmetic, Spanish, and methods to help satisfy the basic necessities for food, clothing, health, and hygiene), education for work and in work (in accord with the natural resources and necessities of each community), and promotion of the awareness of the values of Tarahumara culture and transmission of universal values.

### 3.3 Means

The intention is to optimize the use of the following means:

- a. Radio: Since the goal is a nonformal education that adapts its activity to the necessities of each community, radio will be used as an aid to the animator of the class, especially in the area of fundamental education. Moreover, the radio will be used to train the animator outside the hours of class. There is also a possibility of utilizing the radio as an element in reflection, along with a collection of recorded audio cassettes that would circulate among the schools. One can also think about using the radio as an instrument in unifying the Tarahumara culture, using their cultural forms and methods of communication. In this way radio could also be useful to the small family groups. 11/
- b. Animators: Given that the kind of education to be given will be nonformal, flexible, and work-oriented, and that this assumes that there will be an adaptation of the content of education in each community, the animator is the essential element in the proposed RSs. It is hoped that the animator will be a real change agent in the community where he works. For this purpose he will have to be able to communicate with the community, not only in their language but also respecting and accepting their cultural values. He will have to be able to develop work with the community and carry out both academic and non-academic activities. The animator should also be able to carry on authentic dialogue with students.
- c. Schools: To fulfill the general objectives of community and work-oriented education, schools should be created that are self-sufficient and at the same time provide a favorable field for work education. This self-sufficiency will be brought about by means of small community businesses basically directed toward making use of the natural resources of the area.

Although it will be necessary to have a central meeting hall, the school will not be the only location where educational activity

takes place. This has to permeate the whole life of the community and reach all sectors of the population.

In summary, it is hoped that by restructuring the RSs the following goals might be accomplished: to prepare the Tarahumara people for coming cultural, technological, and economic changes in such a way that they are able to take advantage of these changes in the best manner possible; to help them incorporate themselves into the national development with their own identity and on an equal footing with other social groups.

The RSs would begin operating in an experimental first phase whose object would be to allow RS leaders to judge and modify the program that would be elaborated on the basis of the data from the study.

### 3.4 The Present Situation: The Problems of Changing

For several weeks in June, 1972, the CEE sponsored a seminar for those who would train the future village animators. The purpose was to give them a more complete grasp of the ideas of Paulo Freire and to inform them of other similar experiences of nonformal education in Mexico, both in urban and rural areas. It was hoped by means of the seminar to determine the possibilities of applying the Freire method and other methods of non-formal education in the Tarahumara RSs.

Given that the course for training the animators had been set for October, 1972, it was urgent to develop a way of selecting them; this would assure a solid base for the beginning of the new experiment and would, moreover, provide a knowledge of the level of learning and attitudes of these teachers. At the same time, these data were necessary to develop the training course.

On the other hand, the need was felt to have more knowledge of the specific area where the new schools were to operate. For this reason, the second objective of the seminar was to program field work that was carried out in July and August for the selection of animators, the study of the communities included within the area of interest, and the exploratory study on the possible uses of radio for the project.

However, in July the director of the RSs decided to postpone the analysis of the data in this last study, as well as the training course for animators planned for October. The reason for this was that the proposed project of the CEE would mean that the children would be neglected since the primary audience would be adolescents and adults. The reform project as it was proposed did not interest the missionaries.

There is interest, however, to carry out a program for adult education, but the feeling of the missionaries is that the RSs ought to continue to be devoted to school children. They would like to carry out

some changes that emerge from the results of the preliminary evaluation and the proposal of the agronomist for adapting more work into the formal school setting of the RSs. They also have the help of the students of the School of Communication Science of ITESO.

The project for adult education will have to be carried out as an additional project of the Tarahumara mission. However, the radio hardware, the personnel, and the basic existing organization will continue to be devoted to the school children. It is clear that this decision fundamentally changes the original plan of reform proposed by the CEE.

The enthusiasm observed among the missionaries at the time of the elaboration of the objectives for restructuring the schools rapidly decreased as they felt change drawing closer. Three months before the beginning of the course for training animators, a decision was made to postpone the complete reform. The missionaries were clearly reluctant to make such a drastic change in their work and a compromise was offered instead. What was happening was not hard to understand. It is difficult, from a human point of view, to accept the criticism that a work that had been going on for 15 years and had been directed by people who had dedicated their efforts and much of their lives to it should be seen as deficient and inefficient on the basis of a series of studies by others from outside the Sierra. Such a reaction is understandable from the missionaries' point of view.

From the point of view of the evaluators, however, it seems a waste of energy to multiply educational efforts stemming from the single group of missionaries. The proposed reform rather sees an education project like the RSs as necessarily embracing the whole community. Working within the socio-economic conditions of the Sierra Tarahumara, education should act as a catalyst for development and change and mobilize people to improve their own social, economic, and fundamentally human conditions. It is a question of priorities. From the CEE study it seems clearly urgent to prepare the Tarahumara population of the Sierra for changes that are imminent. The RSs should help the Tarahumara achieve an equitable participation in the changes of the infrastructure and technology while at the same time helping them to maintain their cultural and social organization and not allowing them to be integrated into national life in a way that will maintain their marginal position, without the benefit of their cultural integrity.

The decision of the missionaries is a compromise: they want to continue to educate school children as well as introduce adult education. Such a decision goes against the reform proposed by the CEE which would have called for a completely new organization, different types of personnel, different financial sources for operating the schools, and the creation of a new image among the people. At this point, there is a delay in making change, not a complete refusal. The

missionaries find themselves divided ideologically, concerning objectives for the schools. Since the missionaries are engaged in the work of the Catholic Church, the ultimate decision for such a change rests with the bishop of the Vicar Apostolic of the Tarahumara region. This person resigned two years ago but continues on the job until a successor is named. This situation adds to the uncertainty and creates a problem in making a final decision for change.

In the short run, a meeting to think through the proposed changes with the missionaries has been planned. From such a meeting should come a decision that would hopefully mark the direction that the Radio Schools would take in the future. At this point no one can predict what that direction might be.

#### 4. UPDATE: JANUARY 1975

Many things have happened in the Tarahumara Mission since the preceding pages were written. However, the ultimate direction of the Radio Schools has yet to be defined.

In March, 1973, all the mission personnel of the Tarahumara (about 100 people) held a meeting to discuss the educational problem of the Sierra in general and the future of the RSs in particular. The leitmotif of this meeting was the general uneasiness of missionary educators with their traditional educational methods (formal schools and boarding schools). The general conclusions of the RSs' evaluation of school effectiveness hold true for most of the educational institutions of the Sierra: they benefit mostly white students (even though they were originally intended for Tarahumara students), and their graduates either return to their community to carry out the same activities as their parents--never to apply what they learned in school--or become exploiters of their own people. (Having learned how to read and write, and how to speak Spanish in the case of Tarahumara graduates, they are often elected to local authority positions. Once they obtain power they usually end up taking advantage of their position.) Also, many of the graduates find jobs in the larger towns or cities and never return to their community of origin. Therefore, formal schooling seems to do little, if anything, to better the home communities of the students.

Even though the feeling of uneasiness about these observed results of the institutions is general among the missionaries, no clear alternatives are envisioned. Moreover, the missionaries depend on decisions taken by the superiors of their congregations (about eight congregations of nuns, brothers and priests are represented in the Sierra), and they are in some cases hard to influence.

Partly because of this fact, most of those attending the meeting showed great interest in the different projects proposed for the



RSs. They did not dare, at the moment, to accept radical change for their institutions, but the experience of the Radio Schools which had already accepted change, did throw some light on possible new methods and educational alternatives for their own establishment in the near future:

The projects presented for the RSs were the following:

1. The original plan proposed by the CEE (cf. supra).
2. The agronomist's proposition (boarding schools for Tarahumara children with emphasis on work-oriented education).
3. The simultaneous experimentation of reformed work-oriented education for children and education for adults.
4. The decision should be based on the results of a year-long study of the Tarahumara communities within the chosen area. This study should focus its attention on the way of life of these communities and the main felt and observed needs of their inhabitants--both children and adults--to avoid the errors of an imposed and ineffective educational program.

After much discussion, the general opinion of the assembly favored the fourth proposition. This, however, was not final. RS authorities had to work on the research design in order to define its objectives and methodology. Tarahumara-speaking personnel for the study had to be assigned and prepared for the project. Finally, the four possibilities had to be presented to the Bishop of the Tarahumara for his ultimate decision.

Shortly after this meeting of the Tarahumara Mission, the Director of the RSs was appointed Bishop of the Tarahumara region. The change of bishops distracted attention from other matters for some time. Other problems had to be faced. Profound changes in the structure of the total mission were prepared. Nevertheless, a new director of the RSs was appointed: a young Jesuit student who had worked in the RSs administration during the previous year and who would be able to stay in the Sierra for at least another year.

Even though during 1973 nothing was done to fulfill the decision of the March meeting--i.e., to prepare a research design and the research team needed for the study--the following changes, presented more or less chronologically, were carried out:



1. Summer courses for auxiliary teachers ceased to emphasize proficiency in primary textbooks, but rather focused their attention on having the teachers achieve an understanding of the region they were working in and of the people they were working for, as well as an awareness of the principal problems faced by these people. This produced excellent results, especially on the group of bilingual (Tarahumara) teachers, who were given the most attention.
2. The radio ceased to be used as the principal transmitter of primary curriculum content. Program series were eliminated, and short programs dealing with general knowledge (hygiene, for example) were produced instead. Transmission time was cut back and teachers were asked to prepare their classes with the program and the textbooks as a basis. At the same time, radio programs for Tarahumara adults began to be produced: one-hour Tarahumara-dialect programs were prepared for transmission on Sundays (the day on which the Tarahumara concentrate in the chapel or other central meeting place). The subject matter was similar to that of programs destined for children. The production of these programs for adults, however, soon ceased, because no personnel were available to follow up the effects of those programs.
3. School supervision and materials supply were improved. Special attention was given to Tarahumara schools.
4. A new method for teaching mathematics and a literacy method in Tarahumara--with the assistance of the bilingual teachers--were developed during this period.
5. By the end of the 1973-1974 school year, the radio was not being used at all. Since then, the radio has ceased to operate completely.
6. Also at the end of the 1973-1974 school year, all white schools were closed.

These last two decisions prepared the way for the serious preparation of the study which had been decided on. Before leaving the RSEs, the director prepared the research team, which consists of missionaries and volunteers (although only one member speaks Tarahumara), and asked the CEE and ESAC to prepare a short methodology course for the team in order to enable them to draw up the research design and the instruments for data collection. The research team is now working on the community study, and plans to have the results ready for September 1975. The general objectives of this study are the following:

1. To discover the socio-economic conditions of the communities, the principal interest and needs of the population, and their way of life and of communication, in order to prepare the way for a well based educational program that fits the needs of these communities, within the scope of the original objectives of the new RSs.
2. To carry out a controlled experiment of the new mathematics and literacy methods destined for Tarahumara children in the five Tarahumara schools that remain in operation.

In July, 1974, a new director of the RSs was appointed: a young Jesuit priest full of enthusiasm and optimism. He is now entirely dedicated to the direction of the community study and of the experiment with the new methods.

The events of the last few months reveal the profound interest of the RS personnel in the serious planning of a new informal educational system. Nevertheless, serious problems still threaten the success of the future radio schools:

1. Lack of prepared and stable personnel. RSs still depend largely on volunteers and temporarily assigned missionaries, neither of whom have any special studies in rural education or the use of radio. Even though the recent challenge of designing a new informal educational system which better suits the needs of the Tarahumara Indians has led the RS personnel to study and prepare themselves, the amateur characteristic of the staff makes the RSs overly dependent on outside help and consultation, or leads to serious errors in the planning and programming of activities. On the other hand, the lack of stability of most of the personnel--including the director--results in the institutional instability of the RSs themselves.
2. Finance problems. The RSs still receive only a very small proportion of their operational costs on a regular basis. This causes a vicious circle, since it impedes RS authorities to hire specialized personnel. Lack of prepared personnel makes it more difficult to obtain financing for RS project since these projects are not professionally designed. This problem also distracts the Director's attention; he has to dedicate part of his time to obtain the money necessary to meet monthly deficits.
3. Administrative problems. Government supervision had previously presented no problem. Recently, however,

education and communication authorities are getting stricter about the requirements needed for transmission. Field supervisions are becoming more frequent. Radio speakers are required to have licenses. And all this is happening at a time when radio transmissions have been temporarily suspended. This may cause authorities to cancel the transmission permit and to assign the shortwave frequency elsewhere. Few steps have been taken by RS authorities to avoid these problems.

Once the new program has been designed, care must be taken to evaluate the results of new programs well. An effective feedback system should be included. RS authorities should begin to train their personnel, at all levels, not only in informal education and the use of radio, but also, and very particularly, in Tarahumara dialect and in understanding and appreciating the Tarahumara culture. Teachers must be trained and supervised very carefully, and the identification of teachers with RS goals should be given special attention.

In any event, a whole set of new horizons opens up not only for the RSs, but for the overall educational system of the Tarahumara Mission. The experience of the Radio Schools should prove interesting to follow, especially at a time when the search for new educational radio systems and methods is being intensified in many Latin American countries.

#### REFERENCE NOTES

1. The word "Tarahumara" will refer to the principal Indian group in the Sierra Tarahumara. "Whites" refer to anyone else who is not culturally Indian. Racially, most others would be mestizos--that is, the result of intermarriage of Indians and non-Indians.
2. An ejidatario is a Mexican peasant who works on common land, called an ejido.
3. For additional information on the Tarahumara, see Bennet and Zingg (1935), Champion (1955), Gabjbusek (1953), Kennedy (1961), Lumholtz (1902), Pennington (1963), and Plancarte (1945).
4. Mexico has long had a uniform, official set of free textbooks for primary schools. They are printed and distributed in millions of copies each year. 1972-1973 saw the introduction of revised first and second grade texts.
5. The Supreme Council of the Tarahumara was promoted by the National Indian Institute to achieve a representative organization of the Tarahumara so that they would have a voice in matters of local and national importance.
6. The achievement tests that were used were adapted from tests developed at the National Pedagogical Institute (Instituto Nacional de Pedagogía).
7. For family and background variables, the analysis was only made with the overall mean of all the tests and not for each test separately.
8. The central headquarters of the RSs offers teacher-training courses each summer. Although one would expect that the teachers with more teaching experience would be those with more such courses, it did not turn out this way.
9. A preliminary study of the potential role of radio has been recently undertaken for the RSs by the Schol of Communication Science of the Instituto Tecnológico de Estudios Superiores del Occidente (ITESO) of Guadalajara.
10. For more information on Freire's method the reader is referred to Freire (1970a, 1970b, 1971) and Enríquez (1971).
11. This presents a practical problem since the hours when the Tarahumara family is at home are early in the morning and after dark. During these hours, however, another transmitter broadcasts on the same frequency that the Radio Schools use. Nevertheless, this does not eliminate the possibility of using the commercial station for this purpose, since it can be heard throughout the state.

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## CHAPTER III

### THE MEXICAN RADIOPRIMARIA PROJECT\*

Peter L. Spain

#### 1. OVERVIEW

In and around the city of San Luis Potosi, two hundred sixty miles northwest of Mexico City, a project called radioprimeria began in the fall of 1970. This project brings classes by radio to fourth, fifth, and sixth graders to make up for the lack of teachers in these grades in the rural areas. Radioprimeria is now in its third year; this report represents the first evaluation of the project, and is based on six months' observation in San Luis Potosi.

Seven weeks were spent in the rural communities within thirty miles of San Luis, talking to the parents there about their children, their hopes for their children, and the benefits they felt education might give to their children. A consistent desire for education came out, but with it came the conviction that education is a vehicle by which to escape the rural area. The rural people did not feel that their area was "developable", only that some children could develop themselves enough to go elsewhere.

Elsewhere means the city of San Luis Potosi. The rural people believe that better job opportunities await them there if they come with their primary certificate in hand. Yet that many jobs just do not exist. In August, interviews were held with people who would know-- personnel officers in industry and state labor officials. They spoke of a critical job shortage, of primary and secondary graduates in marginal jobs or no jobs at all, and of the press of rural immigration.

Following a summer in the rural communities and in the industrialists' offices, focus shifted to the school system and the use of radio within it. Achievement tests were given to the sixth-grade students and questionnaires to teachers in all six primary grades. Only some of the students and some of the teachers were using the radioprimeria system, so two groups could be compared. Children taught with the radio, it turned out, were receiving an education comparable to that of the children in the traditional system--that is what the achievement scores indicated. While the organization of the project had not strictly followed its original goals nor had the project been set up in any

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experimental form, some basis was found for being confident that radio can be used to increase education in these rural areas.

Statistical data bear witness to the growing school population, and the need for more school facilities. The few schools that have been expanded by radioprimeria show numerically the increases in enrollment that radioprimeria makes possible.

The teachers themselves are signs to the rural community that education leads to the city. The vast majority of the teachers now commute from the city every day—they do not want to live in the rural areas. If they could teach in the city too, they would prefer that. Though the teachers believe very much in the need and the benefits of rural education, because they commute they do not endorse rural living. It is not surprising that the rural people believe that education is mainly a chance for them to move to the city.

A survey of recent primary graduates showed, however, that the great majority of them have not left the rural area. They have stayed, with their education, in the rural situation where schooling has not been found to have much practical use.

Within the school system was found, in particular, a lack of supervision. The implementation of radioprimeria had been left to individual teachers, and many elements of the system were in disarray. Less than half the radio schools had an audible, functioning radio on the day we visited. The teachers themselves usually provided the radio. It was quite haphazard. A great deal more organization is needed for the radioprimeria system to be operating as had been planned.

The facts that no expenditures have been made in San Luis Potosi and that no new personnel have been hired to supervise the radio project show clearly in these organizational problems. The system differs widely from school to school, and stands most in need of some regular supervision. Certain fortunate circumstances have actually been the basis of the system so far, but now more orderly direction of the project is needed for it to be maintained or grow.

Full primary education in the rural areas is the goal of radioprimeria, but full primary education does not seem to have great practical value in the rural areas. While rural people believe that education can lead to jobs in the city, we found from many employers in San Luis that there are many more educated people than the available jobs can absorb. A rural immigrant's opportunities are slim; he tends to find only marginal work and swell the city's slums. We come to the paradoxical conclusion that there are too many educated people in San Luis--the other sectors of the society are not developed as well as the school system, such as radioprimeria.

So, radioprimeria is seen as somewhat useful in the process of rural education, but rural education emerges--in this rural situation in San Luis Potosi--as hardly useful at all.

## 2. INTRODUCTION TO RADIOPRIMARIA

The Secretariat for Public Education (SEP) in Mexico has concluded that conventional forms of primary school cannot be extended to the whole country. The traditional teacher in his classroom for each grade, even limited to the primary grades of one to six, cannot be continued throughout most of the country, owing to the lack of teachers, buildings, and teaching materials in the rural areas and to the continually mushrooming school population. The Mexican Constitution of 1917 promises a primary education to everyone, but, according to the government's own statistics, out of the 32,855 primary schools in the country only 6,440 have the full six grades.

Even though public education takes the largest single percentage of the national budget, the fact remains that lack of funds is the basic problem. Teachers are unemployed because of the limited number of posts that the Secretariat can sustain. Some solution was needed that could increase the number of students served by the primary educational system without increasing the costs. Mexico turned to educational technology, specifically to radio, to meet this situation.

In the Mexican state of San Luis Potosi, 260 miles northwest of Mexico City, two-thirds of the total 1969 population was under 25 years old. 376,000 persons were between the ages of 6 and 14. The statistics for 1968 showed 218,210 students enrolled in the primary schools within the state. At that time, the primary school system included 54 kindergartens, 1,559 primary schools, and 4,285 teachers. Most of the students, however, do not complete the primary level. In 1969, there were about 68,000 first graders in the State, but only about 14,000 sixth graders.

Some dropouts occur because of academic failure, the need to work to support families, and disinterest on the part of students and their families. However, a major reason for the decreasing enrollment is simply the lack of school facilities.

It is particularly in the rural areas that the enrollment falls off sharply after the early grades of primary. While the total drop from first to sixth grade in the State of San Luis Potosi is from 68,000 to 14,000, in the rural areas this drop is from 48,000 to 3,000. In general terms, this means that while in the whole state one out of five first graders reaches the sixth grade, in the rural areas only one of sixteen does. This does not refer to graduates of the sixth grade, but only to those who reach the sixth grade.

One constant fact in any discussion of Mexican education should be a clear distinction between the urban and rural areas. These statistics provide the first hint of major differences; these differences run through the data, both the statistics and the first-hand observations.

We can consider the progress of the student cohort that entered the first grade in 1963 in the State of San Luis Potosi. In the first year, forty percent of the students dropped out. Only thirty percent reached the fourth grade, and only eighteen percent graduated. In each year, the figures are much worse in the rural areas.

Seven out of ten rural children dropped out by the end of the second year, only fifteen in one hundred went to fourth grade, and only six percent graduated from primary school. For the urban children, the dropout rate is lower and more gradual, and fully half of them graduate from the sixth grade.

Yet the rural schools enroll more than half of all primary students--121,000 out of 218,000, or 56%, in 1968. As noted earlier there are 376,000 children in the State between 6 and 14 years old, so 158,000 do not begin school at all--probably the majority of them live in the rural areas. For the rural students, there are 1,320 schools and 2,200 teachers, while for the urban students there are 239 schools and 1,915 teachers. What does this say? Simply that in the rural areas most of the schools are one- or two-teacher schools, and that the rural schools simply cannot cope with the federal requirement of providing six grades of primary education. The dispersion of students in the rural areas makes it difficult to get the students together--thus the high number of schools for the rural children. The dropout rate is higher for these rural schools, even in the lower grades where schooling is presumably available. We can presume that the efficiency of these schools is not as high as that of the urban schools, in terms of cost per student and, particularly, in term of cost per graduate.

A simple fact becomes clear: the rural areas demand so much in the way of educational resources and personnel that traditional education of one qualified teacher for each grade simply cannot now, nor in the foreseeable future, be extended nationwide.

As an alternative, the system called radioprimeria was created and begun on a small scale in the State of San Luis Potosi, within a thirty-mile radius of the capital city of the same name. The Secretariat, in a brochure describing radioprimeria, stated the goals of the project:

1. that children of school age who live in rural communities and attend schools of less than six grades be able to complete their primary education in the ordinary time of six years;



2. that, as an extension of this project, the opportunity be given to persons above fifteen years of age, who for various reasons did not finish their primary education, to finish these studies as informal students.

In fact, until now, the second purpose of radioprimeria has existed only in principle. Radioprimeria has focussed on the classroom. The basic idea of introducing radio into these schools has been to make up for a lack of money to hire sufficient teachers. While the actual situations in the existing radio schools differ quite a bit, the idea behind radioprimeria was for a six-grade school with four teachers. Three teachers would be handling the first three grades in the traditional way, without radio; the fourth teacher would have the three older grades in one classroom and teach them with the assistance of the radio lessons. Thus, by supplementing the teachers who are now in the school system (not by replacing them), the radio system is meant to allow the full primary course to be taught where it has not been taught before and where its prospects for ever being taught were dim. The saving involved is the lower cost of radioprimeria compared to the salary of two more teachers.

Because of organizational problems elsewhere, the only places where radioprimeria now exists are in one area around the city of San Luis Potosí and in one classroom at the Experimental Education Center in Mexico City. The number of schools was limited to take advantage of the possibilities for experimentation and evaluation; about forty-six schools were meant to be representative of those that would be served by a national system of radioprimeria, and there was also the idea that the broadcasts could be a supplement to the fully staffed urban schools. This has not been stated as a specific goal, but could be an important third focus for the radioprimeria system.

## 2.1 Programming

Substantial themes are selected from the official curriculum of the fourth, fifth, and sixth grades--the only grades for which radioprimeria is broadcast. Emphasis is on Spanish, arithmetic, history, and geography, though material for physical education, nature study, and practical activities is broadcast too. Some themes are classified as "common", meaning that they can be understood by, and are therefore broadcast for, all three grades. Others are classified as "specific", those designed for, and broadcast to, just one of the three grades. This means that some radio programs are intended for all three classes which share one classroom, and that some programs go to only one group within the classroom. When the programs are being broadcast to one grade, the other students in the classroom are supposed to work on their own.

Five or six programs are broadcast each school day, so approximately 1,250 programs are needed to cover the school year. Each

program lasts fourteen minutes. For the most part, the programs have been the same or nearly the same in each of the three years that radio-primaria has existed. So a child who was in the fourth grade in 1970-71 is hearing the same programs this year, 1972-73, for the third time.

These radio lessons are taped by a team of eight radio teachers in the studios of DGEAD in Mexico City. They are shipped by bus to San Luis Potosi, to Station XEXQ, the radio station of the University of San Luis Potosi, where they are broadcast without charge, Monday to Friday, from 9:00 a.m. until 12:45 p.m. In Mexico City, the broadcasts are over Station XEEP an hour earlier.

On the average, in a five-hour school day, an hour and thirty minutes are taken up with radio lessons. Eighty percent of these lessons are for all three grades. For the other three hours and thirty minutes, the teacher directs the class with work activities initiated by the radio. The classroom teachers receive beforehand a document called the "Correo de Radioprimaria", a mimeographed bi-weekly that contains the detailed schedule of radio classes for two weeks. It also contains directions about activities for the teacher, or students, or both, to do before, during, and after the radio broadcast. It suggests teaching material that can be made or that should be on hand for each lesson. At times, the teachers receive visual materials, maps, and pictures produced in color by DGEAD.

Many of the classrooms are of the prefabricated type that is spreading in rural Mexico. These buildings are well lighted by two walls of windows, in contrast to the older buildings that have few windows and are dim even in daytime. Generally a portrait of Juarez hangs in front, and some DGEAD materials, charts or maps, are commonly found even in very rural areas. All rooms have a blackboard. The benches are made for two students, and are generally filled. There is no heat, and winter days can be chilly.

While there are no special printed materials provided for the students in the radio classes, the radio lessons proceed systematically and constantly refer to the free textbooks (textos unicos) given by SEP to all Mexican primary school children.

What makes the Mexican situation interesting is that the use of radio there is trying to stretch the efficiency of the rural teacher, so that with basically the same number of teachers plus radio more children can be offered the full six grades of primary education.

## 2.2 Statistical Data

Myrdal (1970) notes the difficulty of gathering accurate statistics in underdeveloped countries. His experience in Asia leads him to observe: "When nevertheless the educational statistics are probably even less satisfactory than statistics in almost every other

field pertinent to underdevelopment and development, the explanation is, in part, an astonishing carelessness in stating and applying clear definitions, though they should not be too difficult to conceive. In part, also, it is simply the great scarcity and often the absence of comprehensive observations and calculations" (p. 164). The same problems were evident in San Luis Potosi. Statistics were very difficult to summarize because they were often based on different definitions. The lack of uniformity and the basic difficulty of communicating with rural schools had to be taken into account.

The most reliable data may be those on enrollment from year to year in the three federal school zones.

The school population is growing at a tremendous rate. In six years, (1867-1972), one school generation, enrollment has increased fifty-eight percent. We cannot attribute this simply to the population explosion, since we know that there are many children who cannot attend school anyway, due to lack of facilities. Facilities never have caught up with the number of children who should be in school. This increase in enrollment is one definite indication, however, that the facilities are expanding more rapidly than the population increase.

The upper grades are the ones that have increased their enrollment much more than the lower grades. The school system is working hard to increase the number of classrooms for fourth, fifth, and sixth grades; it is trying to expand the more usual three-grade school into a full primary school. The radio schools show less growth, even in the upper three grades--another reflection of the non-controlled development of the radioprimeria system. Theoretically, the radio schools should show an increase from zero starting in 1970, but, of course, we have mentioned that most of the radio schools already had six grades before radio came along. The growth in the non-radio schools is enormous by comparison, and this reflects the greater concentration of resources in the schools closer to the city that are predominantly non-radio (See Table One).

### 2.3 Dropouts

The number of dropouts is a hard figure to come up with. It is possible to add together the children who passed and those who flunked at the end of the year, then subtract this total from the enrollment at the beginning of the year. This should tell us how many students fell by the wayside during that scholastic year. Frequently, however, we found a particular school with more students at the end of the year than at the beginning--what we could call "drop-ins". This occurs because enrollment figures are gathered in early September before the schools get organized, and because of teacher shuffling and the different organizing ability of different teachers, these early enrollments may or may not reflect the real school population of the community. Thus precise dropout figures cannot be estimated for dropouts during the school year.

TABLE ONE

ENROLLMENT IN EACH GRADE IN RELATION TO THE FIRST GRADE  
IN THE SCHOOLS THAT HAVE NEW SIX GRADES SINCE THE  
INTRODUCTION OF RADIOPRIMARIA

| Year              | G r a d e s |    |    |    |    |    |
|-------------------|-------------|----|----|----|----|----|
|                   | 1           | 2  | 3  | 4  | 5  | 6  |
| 1967              | 100         | 64 | 47 | 30 | 9  | 3  |
| 1968              | 100         | 61 | 43 | 33 | 8  | 3  |
| 1969              | 100         | 71 | 58 | 46 | 16 | 4  |
| 1970              | 100         | 71 | 67 | 55 | 12 | 0  |
| 1971 <sup>a</sup> | 100         | 83 | 84 | 67 | 59 | 43 |
| 1972              | 100         | 71 | 57 | 43 | 37 | 29 |

<sup>a</sup> We have figures for 1971 because all these schools are from the school zone whose data were available.

We remember that the radio schools are mostly schools that already had six grades two years ago and that now are almost exclusively six-grade schools, while the non-radio schools include some big suburban schools with large sixth grades as well as the small rural schools with no sixth grades at all. Many of those rural schools are three-grade schools. This basically means that the radio schools have not come close to matching the suburban schools, when averaged with the many rural schools with no sixth grade at all, still have approximately the same dropout rate. But, of course, most of the radio schools had six grades already, before radio.

We get back to the same reality--that most of the radio schools do not fulfill the criterion for being radio schools since they had six grades already. When we look at the radio schools that have in fact expanded to six grades after the introduction of radio, we do see striking progress. Table One shows the relative sizes of all grades year by year. Clearly the upper grades expanded at a rate faster than the lower grades.

### 3. HOW DOES RADIOPRIMARIA WORK?

How well does radioprimeria meet its first goal: to bring more, complete six-year schools to the rural areas? What difficulties come up because of the way radioprimeria is organized in San Luis Potosi? How many children are now in school because of radioprimeria?

In June of 1970, there were seventy schools with fewer than six grades in the three federal school zones of San Luis where radioprimeria came to be implemented. These, of course, are precisely the schools for which radioprimeria was intended--the incomplete schools. But only eight of these seventy incomplete schools used radio over the next two years, and one of these eight dropped radio in September of 1972.

At the end of June 1972, the primary schools in these three zones enrolled 21,107 children, with 2,020 fifth and 1,563 sixth graders. Children in new grades in radio schools numbered 240 (123 in fifth grade and 117 in sixth grade). The increase for these two grades from the introduction of radioprimeria was seven percent.

It is interesting to note that, of the total of forty-four schools in the three federal zones that had six grades in 1969-70 (the year before radio was begun), thirty-six of these were using radio by June of 1972. While radio may be a useful supplement in these complete schools, they do not fit the criterion for which the system was started. That is to say, eighty-two percent of the schools using radio do not fit the criterion--they are not incomplete schools--for which radioprimeria



was started. It is not uncommon that innovations are used most by those who really need them least--radioprimeria stands as another instance of that.

Furthermore, there remain important hardware and administrative problems in San Luis Potosi. On the hardware side, radioprimeria depends on radio receivers that are bought and maintained by the teacher and/or the community. (Usually the teacher--the teacher questionnaire, which will be discussed more thoroughly later on, showed that in three of four cases, the radio was bought by the teacher.) When electricity is lacking, or the batteries run down, or hills obstruct reception, or classroom acoustics are poor, or radio speakers are squawky, the children do not benefit. In some schools, haphazard maintenance hinders continuity in the radio classes. The lack of some central agency to insure receiver quality becomes a felt need for anyone who visits the radio schools.

Administratively, radioprimeria has its most critical problems. Each school zone has its own inspector, who is charged with visiting the schools regularly. Yet the inspector is not provided with a vehicle for this travel, or, as far as one could tell, expenses to maintain his own car. The countryside is very rough on a car, so that maintenance expenses are higher than normal. To inspect the most rural of the approximately fifty schools in his zone, an inspector would have to drive two hours one-way, though other schools would be closer. In three and one-half months of visiting schools, we crossed paths with an inspector only in Saucito and Garita de Jalisco, two schools that are very close to San Luis Potosi. This could have happened by chance, but more likely the inspectors were not doing extensive visiting. One inspector is also the presidente municipal of Soledad Diez Gutierrez (pop. 30,000), and that office demands most of her time.

In the first year of radioprimeria in San Luis Potosi, the Director of the Audiovisual Center made extensive visits, using his own car. In this way he was able to see the precise classroom situations and promote the use of radioprimeria. These visits remain the basis for the whole radioprimeria program, and were the major factor in the initial acceptance of radioprimeria. They represented the most effort made to communicate to the teachers that there was such a thing as radioprimeria and to explain how they might use it.

But those visits were done gratuitously, and the car used is no longer serviceable except for the city. In the visits this year, it was found that some schools were not using radioprimeria because the old teacher had been transferred and the new teacher knew nothing about radioprimeria. Radioprimeria needs a great deal of supervision, as does all rural education. This is not just to check up on the teachers; it is principally to give them encouragement and advice, and in general to maintain communication within the system. But radioprimeria has not such supervision on a formal basis. The fact is, it was learned, that

DGEAD has not spent any money in San Luis for this radioprimeria project. No one has been hired in any capacity. Radioprimeria teachers receive no bonus, nor is the purchase and upkeep of the radio subsidized.

The administrative priority should be for some sort of supervision. Neither the visits that were made two years ago by the Audiovisual Director nor this year's visits were planned by DGEAD, and they will not occur again. If the system is to be maintained, it needs formal supervision on a regular basis. Teacher turnover in any particular school is rapid (more than seventy percent of the teachers have been in their present position for three years or less), so that if continuity in radioprimeria is to be maintained these new teachers need encouragement and instruction in what radioprimeria is.

How, then, in summary, does radioprimeria work? Two basic realities are found to be underlying the situation. First, SEP began radioprimeria in San Luis Potosi without investing any money there. Through chance, the local audiovisual director was able to visit the rural schools in 1970 to get radioprimeria underway, and through chance the present study allowed him to visit the schools again in 1972, to patch up the system. But without regular supervision, the radioprimeria system will run down badly. Radio receivers need more quality control from some central source. Both the administrative and the hardware problems demand some investment from SEP. Radioprimeria cannot continue in the rural areas without such investments.

The second basic reality is that there has been no sustained effort to focus radioprimeria on the incomplete schools. Only seven of the seventy incomplete schools have been brought up to six grades, while thirty-six of the forty-four schools using radioprimeria already had six grades before the program began. It seems that DGEAD leaders feel that the program has moved past the experimental stage just by surviving.

#### 4. OBSERVATIONS OF RADIOPRIMERIA

October and November were spent observing in the schools, both those with radio and those without radio, to see if schools were operating and using radio, and to observe teacher and student attendance. These visits were not intended as pedagogical evaluations, but as a way to see how extensive was the use of radioprimeria in the schools that said they used it. The inaccessibility of the rural area makes the rural teacher very much his own man, particularly when any type of inspection or supervision is absent. By listing all the radio schools in random order and dropping in on them unannounced, it was possible to get a cross-section look at the radioprimeria system. Visits were also made to nine direct teaching schools, to see what the categories "radio school" and "non-radio school" really meant.

This design had the built-in insistence of taking the day of the visit as a typical day. Since visits went in random order, it was felt that some schools were observed on "good" days and some on "bad" days. These data are not to be applied to individual schools; they give the situation of a typical day in the radioprimeria system as whole.

#### 4.1 Were the teachers there?

First, were the schools open? The attendance by the radio-primeria teachers was excellent on the whole, and all but one of the radioprimeria schools were open. Some schools start late much of the time, either because the teacher comes late from the city or he does not insist on punctuality from the students.

Of the nine non-radio schools visited, only four were even open. Can radio be given the credit for this better showing by schools with radio? It is impossible to say. Certainly the data do not detract from radio, and they do seem to support Professor Tristan's speculation that the daily continuity in the radio classes makes it more necessary for the classroom radio teachers to come every day.

Student attendance levels seemed acceptable. Five out of six of the enrolled children were there.

Children coming in till 10:30 was common in several communities; they can hardly take advantage of the radio lessons. In other schools, virtually all the children were in their places at the start of the school day. Evidently tardiness is something the teacher can do something about--another of the struggles that the rural teacher must face. Not enough non-radio schools were observed to say which system had more tardiness.

#### 4.2 Radio use

The more striking item--and the item that should be stressed above all--is the spotty use of radio in the "radio schools". Eighteen of the forty-four schools visited were not using radio on that particular day, while twenty-five schools were using radio, and one school was closed.

Why were eighteen radio schools not using radio? Often the radio was broken, or the electric power had failed. Sometimes the teacher was new and not willing to use radioprimeria. In one place, the teacher and the community could not agree on who would buy the radio. Some teachers were just not convinced that radio would be helpful to them.

Of the twenty-five schools found using radio, seven had radios that were not audible. In two cases, the teachers told the students that they would not be able to hear, and then relayed the lesson from

next to the set. The reception problem is widespread. Maintenance of the radio involves obtaining funds from the community. Small radios and old stone-walled classrooms make hearing in back of some classes difficult even when reception is clear and the radio is in good repair.

Therefore, the radioprimeria system when observed in this random way had only eighteen schools with an audible, functioning radio--eighteen out of forty-four.

Observations of the schools provide evidence of how the system can run down without supervision. Professor Tristan was only able to visit these schools because this research happened to be going on. It has been up to him to convince teachers to use radioprimeria, and he had done that two years ago when he visited the schools in his own car. But now many of those teachers have changed schools, and with no car he is not able to get into the rural area in the way that is needed to maintain the convictions and enthusiasm of the teachers.

With teachers soliciting changes and being changed so much during the first weeks of school, preparation ahead of time is out of the question. One teacher was working his first day at a school visited on October 30. Continuity with the radio lessons from year to year suffers. The number of schools using radio has dropped each year. In 1970-71, there was forty-nine radio schools; forty-four in 1971-72; and there are thirty-seven in 1972-73. Schools move in and out of the radioprimeria system. This reflects the difficulties in organization and supervision, and the movement of teachers within the system. These difficulties have caused the system to run down--approximately a twenty-five percent drop in two years.

One of the principal reasons for personnel changes is that most rural teachers want to be transferred to the city, or closer to the city--as will be seen in the next section. The Federal Office of Primary Education is filled with teachers soliciting changes all during September and into October, while classes go untaught in the rural areas. When these changes are granted, a new teacher is sent into the rural area with no experience in that particular school and with a later start.

Visits to the schools also brought out other difficulties. Student lateness is bad in some places, especially where it is clearly tolerated by the teacher.

The transmission of the radio classes is not always prompt, sometimes as much as ten minutes late. This keeps the classroom teacher in uncertainty, and wastes time.

Finally, some comment should be made about the observations of the classes themselves, and in particular about the classes intended for only one group. An example would be a history class where the radio



class is directed only at the fifth grade; the fourth and sixth graders are given a reading or workbook assignment to do on their own. Though only two of the fifty-six classroom radio teachers who responded to the questionnaire said that these non-listeners "waste time", these students did not show a great deal of concentration at these times.

These observations showed that the radio schools are open. Yet only eighteen of the forty-four schools have an audible, functioning radio. This is an important finding, and is precisely the kind of datum that could only be observed by a supervision team. The visits, while spread over many days, provided a view of one typical day in the life of radioprimeria. Certainly before we can ask about effects, the point has to be made--with emphasis--that on these visits more than half of the radio schools were found to be not functioning.

While teacher and student attendance in radioprimeria is good, the actual use of radio was very spotty indeed. Just the technical task of getting the radio signal into the classroom remains a major difficulty, and tardiness is a serious problem in some places. It does not appear soluble through the goodwill of the teachers alone. More organized supervision of the reception problem--particularly receiver quality and maintenance, but also teacher motivation to use radio--will have to be implemented if these schools can be called radio schools.

## 5. THE ACHIEVEMENT TESTS

Tests were given to all sixth-grade students in all the schools in the three school zones. Six hundred ninety-six of these students were in the radioprimeria schools, and five hundred forty-three were in direct teaching schools. Only the sixth grades were tested in order to gather scores from those radioprimeria students who had used the system for three years. The tests covered Spanish and arithmetic, and were given twice, on in September and once in December. The tests were administered by a group of persons trained for the task. In this way, we had scores for both groups on two dates and we could compare the changes (if any) between the two dates for both groups.

The tests themselves were taken from a booklet of tests prepared some years before by SEP. Each test took an hour.

Table Two shows the results for both groups on both sets in September and December.

One immediate question: why do the non-radio children start higher than the schools that use radioprimeria? The answer appears to lie in the fact that more of the children in the non-radio schools live closer to the city. Tests were given in all the schools in the three school zones that were classified as "rural". But, in reality, some



TABLE TWO

MEANS AND GAIN SCORES IN ARITHMETIC AND SPANISH FOR RADIO AND  
NON-RADIO SCHOOLS IN SEPTEMBER AND DECEMBER

| Subjects              | Radio Classes (N=696) | Non-Radio (N=543) |
|-----------------------|-----------------------|-------------------|
| <b>Arithmetic</b>     |                       |                   |
| Mean score, September | 15.7                  | 20.3              |
| Mean score, December  | 19.0                  | 23.2              |
| Gain                  | 3.3 <sup>a</sup>      | 2.9 <sup>a</sup>  |
| <b>Spanish</b>        |                       |                   |
| Mean score, September | 26.4                  | 30.1              |
| Mean score, December  | 30.1                  | 32.4              |
| Gain                  | 3.7 <sup>a</sup>      | 2.3 <sup>a</sup>  |

<sup>a</sup>

Differences between September and December are all significant beyond the .001 level. Two-tailed t-tests are used in this and all subsequent tables.

schools were more rural than others, and some schools were not rural at all. The classification had not caught up with the growth of the city. Some children had hardly any contact with the city while other children could walk or bicycle there very easily. These schools had some advantages over the more rural schools.

The non-radio schools included three large schools whose students made up approximately forty-two percent of the non-radio children; the means for each of these schools were well above the general mean. These three schools were located very close to the city of San Luis Potosi and they had better facilities than the genuinely rural schools. Scores for the non-radio schools were examined when these schools had been removed from the group. Removal of the three, large, suburban, non-radio schools does show that the other non-radio children started closer to the radio children.

What about the schools that fit the original criterion for radio schools--those schools that did not have six grades before the introduction of radioprimeria? How did they score in relation to all the radio schools as a group? It must be noted that since all the radio schools did not lack six grades before the introduction of radio--in fact, thirty-six of them did not--to compare the radio schools and the non-radio schools directly is not an exact comparison of matched groups with one controlled variable.

In terms of means and gain scores, the radio schools with new sixth grades were not sharply different from the radio schools that had six grades. The means are quite close, and the gains are only a bit less and still significant in themselves.

The radio schools with six grades even before radio's introduction scored significantly better in arithmetic than the radio schools with new sixth grades. They also significantly outperformed the non-radio schools in Spanish--an interesting result in terms of radio's possible ability to supplement a complete six-grade school. The radio schools surpassed the non-radio schools in gain scores when the three large suburban schools were omitted.

Radioprimeria shows that it can be a useful teaching aid, and that it can assist in bringing this level of education to rural areas. While the findings here are encouraging, it must be noted again that this was hardly a well-controlled experimental situation. The majority of the radio schools--as has been mentioned--had six years of schooling before radio was introduced. Many of the direct teaching schools have fourth, fifth, and sixth, or fifth and sixth grades in the same room.

The different circumstances of so many children and the lack of a controlled situation must come into the interpretation of these

learning data. It cannot be said that these two groups were the same except that one group used radio and one group did not. This was not the case.

In summary, radio is helpful in Spanish; radio school children did significantly better. No significant differences show up in arithmetic between the radio and non-radio groups, but there too radio school children did better. The rise in Spanish scores may come naturally from the verbal radio medium, though we have noted other explanations that might explain the highly significant gain observed.

The main finding from these learning tests seems to be that radio classes can indeed supplement direct teaching as a learning tool, and that the type of rural education that is given by a teacher can be given to a larger group or groups of children with radio as a teaching aid to the teacher. The hope was, in designing radioprimeria, that the type and quality of rural education presently being given in only a few parts of Mexico could be given in more areas through the use of radio and without increasing the number of teachers. It seems that this can be done. It seems advisable, however, to try to get firmer data about learning by a more controlled and genuinely experimental assessment of the radioprimeria system.

## 6. THE TEACHERS' QUESTIONNAIRE

A seventy-five item questionnaire was designed for all teachers in the three school zones under study. Seven pages long, it took about thirty minutes to fill out.

Of the approximately three hundred questionnaires that were distributed, two hundred thirty-one, or about seventy-seven percent, were filled out and returned. Fifty-six of these were from the eighty-four classroom Radio teachers--sixty-seven percent.

### 6.1 The larger group of teachers

First, we consider all two hundred and thirty-one teachers. A great deal of transience was found among the teachers, they do not tend to teach in one place very long--and the vast majority of the teachers do not live where they teach. Fully seventy percent have been teaching in their present location for three years or less. Even more, seventy-eight percent, do not live in the community where they teach. Basically teachers are not rural people; even if they are born in the rural area, their training in the urban Normal School opens them to the style of city living.

According to an estimate by Professor Nunes, the Federal Director of Primary Education, ninety-five percent of the rural teachers

would prefer to teach in the city. So the teachers were asked this question: I prefer teaching in the rural area rather than in the city--yes or no? Twenty-nine percent said "yes", they preferred rural teaching; forty-three percent said "no", they preferred the city. And, interestingly, twenty-seven percent gave no answer. Many teachers seemed to tiptoe around this question. Did they feel that their anonymity might not be secure, that to say they preferred a move would jeopardize their job or that to express satisfaction in the rural area would keep them there indefinitely? Professor Nunes notes that young teachers accept rural posts for a few years, but then insist that they have a job in the city.

The focus of these commuter teachers, then, is on the comforts and their families in the city. They do not have other jobs for the most part (eighty-six percent do not), but they are not content teaching in the rural area.

When the teachers were asked if they preferred to teach in the rural area or not, the results correlated significantly with four other items. Correlations indicated that teachers who prefer to teach in the city--more so than those who prefer rural teaching--think learning does have rural value. They feel teaching is a satisfying profession, but would not push their students to become teachers; in fact, they would work in some other better-paying job if they could find one. Teachers who prefer rural teaching are more satisfied and would stay on the job despite the pay; they would also be more likely to encourage their better students to become teachers.

It seems that teachers who prefer city teaching are less committed to teaching itself. They keep their eyes open for better offers and feel their students can do better than be teachers themselves. Yet they do not disparage rural learning; they simply do not want to be rural teachers.

## 6.2 The value of rural education

A series of questions about the value of rural education brought some puzzling results, contrasting with parents' views of rural education (described in the next section). Ninety-one percent disagreed that "learning, frankly, has no value in the rural area"; the teachers seem to feel that schooling has some payoff there. Yet seventy-six percent agreed that it is better for a child with primary education to move to the city.

Eighty-five percent agreed that education is the most important factor for the development of the rural areas, and eighty-eight percent agreed that the rural teacher contributed a great deal to the development of Mexico. Eighty-eight percent also agreed that the only role for primary school is to prepare children for secondary school. The teachers imply that the primary education in itself has some value in the

rural areas, even though they did say it was better to go to the city. This optimism about rural education is not shared by parents or by labor leaders--as later sections will describe. The teachers have a much more hopeful view of what education can do for the rural areas.

As to whether education will solve rural needs, forty-one percent agreed that it will not, but thirty-seven percent feel that it will. The question is badly stated so that these thirty-seven percent of the teachers are saying that all the rural areas need is more education, and then rural problems will be solved. They see education as the solution.

Using the question about education as a solution to rural needs, we correlated various items with it. Four correlations stood out with significance. This question correlated highly with a similar question about education's rural value. Also, quite logically, those who doubted education's rural education believed more in the value of radio over direct teaching. And, strikingly, the teachers who live in rural areas are precisely the ones who believe that education is not the solution to rural needs. This last point reflects what familiarity with the concrete situation contributes to the teachers' expectations for rural solutions through education alone.

### 6.3 Teaching as a profession

How do they feel about the teaching profession? Sixty-one percent said, indeed, it was a satisfying profession, but twenty-three percent--nearly one out of four--said it was not. Forty-eight percent said they would continue teaching even if a better-paying job was available elsewhere; thirty-five percent said they would take the other job.

The teachers do not seem enthusiastic about their jobs, as a group. The forty-three percent who would turn down a better-paying job to continue teaching are probably the most dedicated and happiest of the group in their work. A large percentage of the teachers, however, are not that committed and would work elsewhere if they could. Teachers' pay is low, beginning at round 1,500 pesos (\$120) a month. Even after eighteen years, one teacher told us, he is only receiving 1,900 pesos (152) a month.

The teachers were consistent in their views about radio. The responses of those who felt teachers can teach better without radio correlated logically and significantly with the following questions:

- Direct teaching is better.
- Radioprimeria contributes little to rural needs.



- Radioprimary should be expanded. This correlation points to the belief of these otherwise skeptical teachers that radio does offer possibilities for education where there are none now. Though teachers are better than the radioprimary system, this correlation is saying, radio may be the only solution in some places, so it should be expanded.

- Reception is poor.
- Programs are too fast.
- Teachers' voices are difficult to understand.
- Students do not pay attention.
- The signal is not clear.
- Radioprimary is too fast.
- Radioprimary leaves too little time between programs.
- Radioprimary has too much content.

Those who believe radioprimary is better than direct teaching are consistently in disagreement with these opinions. A further correlation on radio problems showed the same significant consistency with these items.

#### 6.4 Supervision

Finally a note about the teachers' felt need for more supervision. Fifty-nine percent felt little or no need for more teacher supervision, while thirty-five percent said they did feel such a need. When the question was phrased differently—"the rural teacher is isolated, does not receive enough attention or supervision"—thirty-seven percent agreed with that, and forty-five percent disagreed. The teachers clearly do not feel as strongly about the need for more supervision as we do; but, of course, their perspective on the whole system is different. They may see supervision only as a threat to their way of teaching, and not consider it advantageous to the system as a whole.

#### 6.5 The classroom radio teachers

Did these fifty-six classroom radio teachers feel that it would be better to teach without radio? Forty-three percent said it would be better without radio, while forty-five percent felt radio made the teaching situation better. Their enthusiasm is hardly unbounded—one out of eight did not know what to say to this question. Therefore, saying that radio automatically captivates the teachers cannot be justified. Teachers had to be persuaded to use it, and close to half seem to remain unconvinced. This same question was asked in a slightly

different form: Is the use of radio as a teaching aid better than direct teaching alone? Forty-eight percent said it was, forty-six percent said it was not.

Only ten percent of the teachers felt that the classroom teacher gave up some of this authority to the teacher on the broadcast. Eighteen percent felt that radioprimary lessened the classroom teacher's importance, and twelve percent agreed it hindered the teacher-pupil relationship. Other potential problems were also mentioned, but only by a relatively small percentage of the classroom radio teachers.

The problems that stand out from the teachers' responses relate to the clarity of the signal and the speed of the programs. Several questions touched on each of these points, and a certain consistency came through.

Sixty-four percent of the classroom radio teachers replied that lack of clear radio reception was a serious or very serious problem. To a similar question, forty-six percent replied that the signal at their school was clear "almost never" or only "at times". They placed the blame not on their radio but on the transmitter--almost three of four said their radio worked well all the time or almost all the time. (Remember that seventy-five percent of the radios belong to the teachers personally.) It may be that the almost even split among the teachers for and against radio is based partly on these reception difficulties. The radio programs are not always clear, they say. Perhaps many teachers look on radio as somewhat problematic, not a sure thing, and at times an added difficulty for them. Certainly the observations in the schools showed that reception is a genuine problem.

Fifty-five percent said that the speed of the programs is a serious or very serious problem. Eighty-four percent replied that radioprimary is too fast at least at times and two out of three teachers felt that "at times" or "almost always" radioprimary leaves too little time for classroom activities. Even more teachers said arithmetic needs more time after the broadcast--eighty-two percent said this--and sixty-one percent said language classes needed more time after the broadcast. In addition to the speed, the broadcasts are too close together, say these teachers. They find too much content in the programs; eighty-one percent of them said that, at least "at times", radioprimary has too much content. Fifty-four percent replied that lack of student attention was a serious or very serious problem.

These teacher opinions bring out definite problems within the radioprimary system. The technical problem of radio reception can be remedied in a fairly straightforward way, but the questions of speed and content are more subtle, pedagogical ones. There may be some relation, however, between the two. Programs which cannot be heard well discourage attention and assimilation; the perceived content becomes greater

when it is more difficult to understand. As in listening to a foreign language at first, it seems so fast and so complex because it is poorly understood.

#### 6.6 Expand radioprimeria?

Seventy percent of the responding classroom radio teachers agreed that radioprimeria was good and should be expanded. Since less than half had felt that radio was better than direct teaching, this seventy percent may indicate that the teachers realize that direct teaching will not be able to do the job--it is too expensive. They realize that something else must fill in for the lack of teachers and think that radioprimeria may be that something. And they as teachers evidently find it somewhat helpful for themselves. Eighty-two percent replied that the radio classes helped them with their own teaching methods; and, to another question, again eighty-two percent said that radioprimeria has helped them to organize their own work. They find the Correo understandable and obviously helpful to them in organizing their daily work in front of several groups. Evidently some of the most important beneficiaries of the radioprimeria system are the teachers themselves.

#### Summary

The most striking finding from the teachers' questionnaire is how transient and how city-oriented are the rural teachers. In their own lives, the city is where they want to be. Most of them live there, and most of them wish they were teaching there.

They are not cynical about rural education, however. It is the key for rural development in their view, and for some teachers it appears to be the solution to all rural problems. While they feel education can be better used in the city, they by no means deny its value in the rural situation. They feel that primary education is a valuable asset to a person living in the rural area, and that primary education need not lead to secondary school to have any value. In the teachers' opinion, it is valuable itself in the rural area.

The classroom radio teachers are not all in favor of radioprimeria, but most of them feel it should be expanded. They see important problems within the radioprimeria system--particularly relating to the speed and the clarity of the programs. Radioprimeria is not generally a threat to them in their role as teachers or their relations with the students. The impression from the classroom radio teachers' questionnaires is that they are using radioprimeria because they have been talked into it; while the experience with radioprimeria has not made them promoters of the system, they find it somewhat of a help and see that it might be one solution to the problem of rural education.

## 7. INTERVIEWS WITH THE RURAL PEOPLE

Aside from the measures or observations of what is going on within the school system, it seemed worthwhile to ask about the relation of the school system to the social system, the society. Is there any benefit to rural Mexican society from improvements in rural education? What will rural children be able to do after finishing the six years of primary?

So, before even visiting the schools, during more than seven weeks in June and July of 1972, visits were made to rural communities within a small radius of the city of San Luis Potosí to talk with the people there about education and its role in their communities. Eight communities were visited and, of these, six were communities with radioprimeria in their schools and with the full six grades. The other two had direct teaching schools, one with six grades and one with four.

### 7.1 Interview format

Before each interview, we explained why we were there and then asked the people being interviewed if they had any children in the school. A series of questions formed the basis of the ensuing conversation. What about their own education? Why do you send your children to school? What hopes do you have for your children with education? Is it good to have a school here? Could you say why? What do you (or your husband) do? Is your education sufficient for that job? Would more education have been helpful for your present work? What will your children do after finishing school? Will they use what they have learned? Do you need the primary certificate to work here in this community? Elsewhere? What do most of the primary graduates do now? Has education changed them? Do many go to secondary school from here? Is there a difference between a primary graduate who has no more schooling and a primary dropout? Why do students dropout? What are the community's needs? Has the learning given from the school helped with those needs? Do the teachers have a community role? Does the school have a community role? How much does it cost to send your child to school each month? Is there a radio in the school here? What is it used for?

Three hundred fifty-two people were interviewed, in eight communities. Not all the persons interviewed were parents, and when parents were interviewed they were questioned separately.

### 7.2 The responses

The almost universal reaction was that school was good, and that "I will send my children to school." Most of the parents went to only one or two grades of primary school, and can only sign their names



and do a little arithmetic. They want more education for their children than they received. When asked why more education was good, the typical reaction was hesitation leading to a circular response such as "It's just good."

Why do they see it as good? In communities closer to San Luis Potosi, people would relate more education to better work in the city, and the possibility of secondary school. To go to secondary school, more than a primary certificate is needed; money is needed too. Whereas primary school has no tuition or textbook fees, secondary schools do. Books are quite expensive. These financial barriers to secondary school usually include travel and/or living expenses in another community. Only one community among these eight had a secondary school.

### 7.3 Education's value

However, there was broad agreement that neither primary education nor secondary education had great value within rural communities. People would say that education was helpful for city life and for finding work in the city. Quite representative is the remark of a family man who said the primary certificate is needed for work in the city, but not here. Many people were puzzled when asked how learning might be useful in their communities, as if they had never thought that learning should relate to their communities. Some saw it as a dumb or naive question asked by someone unfamiliar with their situation. One woman laughed.

How does this square with the other impression that almost everyone felt school was a good thing and would send their children to school? Simply put, the rural people would like (at least for their children) to live in the city, and nobody succeeds in the city without education. They have no dreams of developing their rural communities, and do not seem to expect education to be for that. Like parents everywhere, they want their children to have more than they had.

These responses are part of a universal desire for more education. "The social demand for education is constantly increasing.... Parents generally want their children to have a higher degree of education than they had themselves. Education is regarded as the primary instrument in social mobility, even if the vistas it is reputed to open up turn out to be fictitious." (Faure, et al., p. 31).

They also fear the city and city people. They know that they are vulnerable to exploitation by better educated people. More education, they seem to feel, would give them more power in their contact with the city. They would not be cheated at the market or tricked by mysterious words on paper. Parents talked about bringing their children with them to the city now to help them in their buying and selling on market days.



From the interviews, however, it does not seem that primary education has been a passport to the city. Jobs are too scarce in the city (as the next section describes). Most graduates work in agriculture or raising animals or in making rope like their fathers do. (A study of the primary graduates -- that will be described in its own section--showed, however, that most of them do not leave the rural area. The teachers were asked where their graduates of last June are now living; they replied that ten percent had moved away and that seventy-three percent still lived in the community. The teachers were unsure about seventeen percent.) Few use what they learned in their work--it is simply not needed for work in the rural area. Only in their contacts with the city does learning seem helpful. Within the community, people said time and again, the primary certificate is not needed, nor is there a practical difference (e.g., in employment) between primary graduates and primary dropouts, within the rural community.

The review of this rural population about education's value in their area seem to bolster that of Griffiths (1968) who wrote: "I hold the view, based on my own experience--and I have seen no evidence to the contrary--that in backward rural areas the schools cannot be made a main instrument of progress" (p. 11). He feels that economic development spurs education, not vice versa; his views come from years of experience in rural Sudan.

But Jamison (1971) presents some evidence to the contrary from an agroeconomic survey done in Indonesia. While he qualifies the results presented, he does provide a regression that associates higher education with increased agricultural productivity. In the United States, Griliches (1970) has shown similar findings from the improvement of education in rural areas. Those findings support Schultz' (1964) argument that education holds much value for rural areas. Schultz advocates primary schooling as the first step toward an agricultural extension service that will really effect rural growth. Yet his argument is weakened by elements that Griffiths mentioned. Griffiths noted: "There are two less obvious features of traditional rural life which it would be unwise to overlook if one wishes to change that life. These are the existence of a social ceiling to individual ambition, and the traditional attitude to authority" (p. 15). Schultz admits this: "What is the rate of return to investment in schooling in farm children? For primary schooling, it is likely to be very high except in those communities that continue to depend wholly on traditionally agricultural factors and in those that thwart the economic incentives and opportunities to modernize agriculture" (p. 204).

What Schultz is talking about is an extension service that fits on top of the primary education system, giving that system a complementary structure that makes primary schooling immediately useful. As yet, there is no extension service reaching into rural San Luis Potosi to improve traditional farming methods. In Section Ten, we

present an incident that illustrates the social pressures against modernization. The value of education is minimized in such a setting. Our rural interviews corroborate this.

#### 7.4 Community needs

The people were quite often hard put to express any community needs. They would mention the lack of water and light quite often; a few would mention better roads or maybe a telephone, both in the context of getting better medical care. In one community, the road is so bad that the doctor charges thirty-five pesos (\$2.80) just to come. This cost, and the fact that there is no phone to call him anyway, causes many children to die from fairly simple illness during the winter. An old woman there told sadly of such tragedies in her own family.

But few people state their problems so well. Perhaps they were afraid of us as city people, but it seemed that they just were resigned to their situations. Most striking in this respect was a community located near the city. It had, for some reason, become the city dump. Trucks bounced up the road all day, bringing garbage and dumping it in the fields there. The result: flies, thousands of flies. Particularly during the wetter months of June and July, the flies swarmed through town in clouds and their buzz formed the background for the interviews. When it was routinely asked of the people what were the needs or problems in the community, not one of the forty-nine mentioned the garbage or the flies. If pressed for an answer, some mentioned the lack of water and light but still no mention of the garbage or the flies. But, when asked pointedly if there were any health problems from the flies, they told a long story of appeals to officials in San Luis Potosi to put a stop to the dumping, the failure of the repeated appeals, the health problems caused especially to the children, and the conclusion of hopelessness to do anything about it. They had found themselves powerless before the forces of the city, and had not even thought about mentioning the matter to us.

Another example of this powerlessness came to light in a more remote town. The first day we arrived there, we were met by a number of men who were very concerned about who we were and why we were there. It seems that the year before two men had arrived in a Volkswagen too, robbed the village, and attacked the people. The intruders, with a car and a gun, were able to pull off such an action without serious opposition or pursuit. For us, it was a lesson about the fear that reigns in the countryside, particularly a fear of exploitation by the "city"--with the education and technology and all that "city" implies to them.

The men there questioned us closely and became convinced, slowly, that we were who we said we were. They insisted, however, that when we returned the next day we have a letter from the education officials in San Luis to back up our explanation. So, next day, we had the letter they requested, written on official stationery with seals

from the Office of Education and signed by the federal official. But it turned out that there was no one in the community who could read the letter--not even the judge. He looked at it officiously for a minute or so, then asked that we read the letter to him.

Whatever explanation the people gave for the value of education--and often they could not express themselves well--was related to success in city things like work or more education or marketing. There was very little expression of hope for improvements in their rural communities from education. Education seems to hold out a hope, however rarely reinforced, that city life is possible for a rural person. The alternative, as one woman put it, is to remain in the rural area. School is useful only if you leave here, she said; it helps you to find work elsewhere--if you cannot find work, you stay here and "continue suffering".

#### 7.5 The role of the schools

School is not related in the people's minds to the needs they most often mentioned--light, water, better roads. At times, an individual teacher took the initiative to solve these problems. But the changes did not come from better educated young people within the community itself.

As such, neither the teacher nor the school has a community role in the people's minds. Rare was the teacher who contributed to the community outside the classroom. For the most part, people said that the school and the teacher were just for the children.

Even rarer was the teacher who lived in the community, as has been noted earlier. Seventy-eight percent of the teachers responding to the questionnaire (and ninety-five percent of the classroom radio teachers) commute daily or at least weekly, from San Luis Potosi. This represents another lesson to the community about education's relation to the city. Before the improvement of the roads, of bus service and cars, the teacher lived in the community. Now he need not, and he does not. This fact is not lost in the people in their understanding of what education might do for them.

When school began on September 4, many rural teachers were not in their schools, but at the Education Office in San Luis seeking a transfer to a city school. There were crowds of teachers at the office well into October while rural schools went unattended. Not only was learning time lost, but also the rural community understood that the teacher would prefer to teach in the city.

#### 7.6 Costs

Despite the government's efforts to provide free primary education, primary school still has real costs to the parents. Questions

were not asked about school costs until some women in one community complained about costs. These costs include pencils and notebooks, purchase and maintenance of the radio, better clothes for the children, and some improvements for the school. Estimates of these costs ranged from one peso a month up to thirty-five, with five pesos being mentioned most often. Since most families have more than one school-age child, these costs can mount up.

### 7.7 Dropouts

Furthermore, there are the opportunity costs to families whose children are in school, thus not helping the family in farming or rope-making. Many fathers took their children out of school to plant and harvest. These cost factors, real and opportunity, were the main reasons for dropouts that the people mentioned. Some parents prefer that their children drop out after a few years of primary once the children have some basic skills. As the child grows older, the opportunity costs of his time in school go up, and the parents are more reluctant to pay the costs. Statistics on one hundred forty-three schools in the three school zones near the city of San Luis Potosi show a universal drop in enrollment from first to sixth grade. It seems that the parents' conviction that school is good is too vague to overcome the realities of earning power foregone or a child unenthusiastic about school anyway. These are the central reasons for dropouts.

Finally, awareness of radioprimeria was not widespread. Parents with children in grades four, five, and six were usually -- but not always -- aware of it. They were aware if they had to pay some of the costs. Other people often did not know about the radio, and this seems to indicate that the introduction of radioprimeria was not a community event, nor is its presence considered important enough to be gossiped about. One boy, who had graduated from the sixth grade the June before radio was introduced, had not heard about radioprimeria from his younger friends. Neither had a priest, who had been ten years in his town, heard about radioprimeria there.

Generally, people who knew about it felt radioprimeria was a good thing. The level of awareness of radio's role, and how it was used, seemed low, however. A few people indicated that radio would not be needed if the teachers were not so lazy. But feelings about the radio were not strong. When a classroom radio teacher would transfer and the new teacher not use radio, no one from the community ever protested to the center.

### 7.8 Summary

These interviews leave two broad impressions on which to base a conclusion.



First, there is the almost universal desire for schooling. Hardly anyone thought school was a waste of time; they wanted to send their children to school. Second, very few people thought primary education would make much difference for someone living in the rural area, but it would be helpful if the graduate moved to the city.

So the inescapable conclusion is that the rural people want their children to be educated in the hope that they can move away to the city. Unlike the teachers, they do not see education as a key to rural development; they do not see rural value in education. They do not think in terms of developing their own area. The idea is to develop yourself through education, and then go elsewhere. This is how school relates to their social situation.

Radioprimeria is not a splashy innovation. Many people have not heard of it. Radioprimeria does not impress the rural people as being a new stage in their educational possibilities -- it is an aid to the traditional system, but not something that has captured their imagination.

#### 8. INDUSTRIES AND LABOR OFFICES

Interviews were also conducted with the personnel departments of the major industries -- twenty-one of them -- in or very near to the city of San Luis Potosi, with people at the industry-sponsored Center for the Socio-Economic Study of the Private Sector of San Luis Potosi (CESESPPAC), and with government labor officials. The purpose here was to examine the labor situation, to assess the opportunities a rural person has in the city, with and without primary education. The rural people had talked so much about the primary certificate being useful in the city, it seemed useful to learn from employers what the labor situation was.

The interview with personnel officers touched on five questions:

1. What are the requirements for work in this company?
2. What kind of a job can a primary graduate get here?
- 3.. How many people work here who do not have their primary certificate?
4. Does the company offer further training to workers with just a primary education?



5. What further opportunities does a primary graduate have with this company?

The requirements turned out to be quite uniform.

Asarco Mexicana, a large chemical company, hires only fathers and sons of present employees, but also demands the primary certificate, letters, military service, and photographs.

The most generally required items -- primary education and completed military service -- are notable, because of the time span between them. Young men are required to serve their military obligation during their nineteenth year, well after they may have finished primary school at thirteen or fourteen, or less. Rural boys most probably spend these intervening years in their rural communities, not using the learning from their primary education. The army is said to teach some basic literacy skills, but soldiers only serve on Sundays for one year so that what is learned would be minimal. By the time they begin their twentieth year, their learning has certainly been forgotten to some large degree, if they have not been using it -- and the rural people say learning is not used in the rural area.

Primary education is indeed required for most industrial jobs. Once a boy drops out of primary school, he has effectively eliminated himself from such jobs. The other requisites are much easier to acquire -- of course, military service is required.

An official of the State Labor Office talked about the opportunities open to a rural young man or woman who comes to the city with his primary certificate. He said that the rural person with his primary schooling can only hope to find work in industries as an unskilled laborer -- a janitor or a construction worker. (These jobs, and most of the jobs mentioned in this section, are only for men.) But he is still above the illiterates and perhaps he can acquire a better job, like paymaster or an employee who is trusted. City people with only primary schooling are in the same situation, he said; the best jobs, those with a lot of responsibility, are reserved for the professionally educated people, way above the level of the rural person.

But, according to an official of CESESPPAC, the industry-sponsored socio-economic study center, the employment situation is so critical that the primary certificate has hardly any value. He insisted that to get a job in the city of San Luis Potosi, you need secondary education and that because of the over-supply of even people with secondary education, the companies and factories can be demanding. The best thing, he thought, for the primary graduate to do is to go to secondary school. At times, he said, you can get marginal jobs with primary schooling, or even without the primary certificate. He noted that San Luis has the circle of poverty (slums that surround the city,

and that are constantly swollen by the influx of rural people looking for jobs that are not available) that exists around all sizable Latin American cities, and that the people living in these slums often have primary education. The real need in and around the cities is for more technical and specifically agricultural training.

### 8.1 The kinds of jobs

The industries themselves mentioned the following jobs as open to the primary school graduate: janitor; laborer, with the possibility of advancing to foreman (several companies mention the possibility of advancement, dependent on the worker himself); driver; welder; construction worker; messenger; watchman; doorman; weigher; laboratory aid; engineer's helper; trainee to operate machinery; stevedore; warehouse attendant; loom operator; truck loader; and the other low jobs.

Several of these jobs, especially laborer, were mentioned more than once, and seven of the personnel officers mentioned that better positions were possible for a men with some experience in his job.

Some factories or companies in fact employ workers who are not primary graduates. Evidently they list the primary certificate among their requirements while in reality the job may not demand more than manual labor. Other companies have one or two less-educated workers, in the lowest positions in the company and hired long ago. The requirements of primary education are not enforced one hundred percent, but the advantage remains with the primary graduate.

While many of the companies demand only the primary certificate, several personnel officers say they give preference to applicants with more studies, and make it clear that there are enough applicants with more studies so that they can be selective. As one personnel officer put it, "The primary certificate is required to work here, but preference is given to persons who have more studies." Other hiring officers said similar things. They seem to be in the favorable position of having more qualified applicants than they stated requirements. Their accumulated comments bear out what the CESESPPAC official said: the best thing for a primary graduate to do is to go to secondary school.

### 8.2 The number of jobs

But how many jobs are there? Figures on the number of employees in all twenty-one factories were not available, but for seven factories the average is one hundred seventy-one jobs. Or, for all twenty-one companies, about thirty-six hundred jobs. Yet according to the 1970 census, the municipality of San Luis Potosi (basically the city by itself) has 42,534 persons with sixth-grade education and 33,020 persons with more than sixth-grade education: 75,554 persons in all. While the factories visited do not exhaust the industry in San Luis, and

while other forms of employment certainly exist, these factories do form a significant part of the job market. The local industries have a tremendous pool of people from which to hire, and the education figures do not reflect any immigration from rural areas.

### 8.3 Summary

From these interviews, it becomes clear, paradoxically, that the people in the area of San Luis Potosi are over-educated, that companies can take their pick of qualified primary and secondary graduates. The other side of the coin, of course, is that there is too little industry, that there is not enough appropriate employment for the graduates of the present school system, even within the city. Despite the problems within the society that limit the opportunities for schooling, especially in the rural areas, the school system is producing more educated people than the society in the area of San Luis Potosi can absorb. The real problems within the society are those that limit the opportunities to use the schooling that is given.

The emphasis on the increase in school facilities will not have effects in the society until other institutions and structures within the society receive equal emphasis. When a young person gets out of primary school today, there are not enough other institutions in the society to receive him. Industry is very limited, secondary schools are few and expensive, the military is years away.

This is the central question that an evaluation of radio-primaria brings out.

## 9. SURVEY OF THE 1972 PRIMARY GRADUATES

We were able to get lists of the names of all the June 1972 graduates from the sixth grades in the region of San Luis Potosi that we were studying. These names were put onto a questionnaire sheet which was then delivered to the particular school in question. The sixth-grade teacher was asked to supply information on the present activities of his sixth graders from the previous year. Were they working? If so, were they working in the community or elsewhere? Were they studying? If so, here or elsewhere? And finally, were they still living in the community?

In some cases where the teacher was new this year, we asked him to get the information from other teachers or from the students as best he could. The purpose is to indicate the activities of the 1972's sixth graders several months after their graduation.

## 9.1 The Survey

The lists went out to fifty-seven schools, and returns were received from thirty-six of these; twenty-three of the responding schools were radio schools, and the other thirteen used directly teaching. Of the twenty-one non-responding schools, eight used radio and thirteen did not. Two mailings of reminder letters went out after the lists were distributed in September. The higher response rate from the radio schools can probably be explained by our observation visits. We dropped in on all the radio schools, and during the course of our visit always inquired about missing graduate questionnaires.

The returned questions gave information on eight hundred twenty-nine graduates from June 1972.

While the non-radio schools make up only thirty-six percent of the total number of schools reporting, they account for fifty-five percent of the students. They average thirty-six graduates apiece, to only sixteen apiece for the radio schools. This results from the several particularly large schools included in the non-radio group. For example, Tercera Grande listed eighty-two students, Pedro Montoya had eighty-eight, San Felipe had sixty, and Colonia Satellite had forty-nine. These four schools are close to the city, near or on paved roads.

## 9.2 The Results

This questionnaire was simple and straightforward. The teacher only had to mark "yes" or "no" or leave blank the boxes next to the questions. Table Three actually contains all the questions asked, together with the results in frequencies and percentages.

In all cases, the percentages given are percentages of the entire eight hundred twenty-nine.

The same percentages of the graduates--thirty-five percent--are studying as are working, according to the teachers' replies. Of those who are working, the teachers knew of about sixty percent who were working in that same community, while they could specify only sixteen percent who definitely were working elsewhere. In reference to studies, the picture is different. More than half who do study are studying elsewhere, while three of seven study in their own communities. Yet many teachers listed graduates as continuing to study in their communities, even though the community had no secondary school. Twenty-three students were named who came from communities like these. This confusion on the part of the teachers probably hides a more weighted percentage of students who study outside their communities. It reduces that percentage of "graduates studying here" from fifteen to twelve percent and the absolute numbers from one hundred twenty-one to ninety-eight.



TABLE THREE

FREQUENCIES AND PERCENTAGES OF THE RESPONSES TO THE GRADUATES' QUESTIONNAIRE

| Question       | Frequency | Percentage |
|----------------|-----------|------------|
| Working?       |           |            |
| Yes?           | 288       | 35         |
| No?            | 229       | 28         |
| No answer      | 312       | 38         |
| Working here?  |           |            |
| Yes?           | 188       | 23         |
| No?            | 50        | 6          |
| No answer      | 50        | 6          |
| Studying?      |           |            |
| Yes?           | 289       | 35         |
| No?            | 305       | 37         |
| No answer      | 234       | 28         |
| Studying here? |           |            |
| Yes?           | 121       | 15         |
| No?            | 160       | 19         |
| No answer      | 8         | 1          |
| Living here?   |           |            |
| Yes?           | 608       | 73         |
| No?            | 83        | 10         |
| No answer      | 138       | 17         |

In any case there are at least one hundred sixty graduates who study outside of their communities while only fifty graduates are known to work out of town. Most of those who work are working in their communities, and, from what the rural people told us in our interviews, they are probably not using their schooling in their work.

The number of those studying is somewhat surprising in the light of the interviews with the rural people. They gave the idea that secondary schooling was a remote possibility for most. The number of graduates now studying is two hundred eighty-nine. Looking at the communities reporting graduates now studying, we find two hundred and seven of these two hundred eighty-nine to be in large urban or suburban communities.

These two hundred seven graduates represent seventy-two percent of all graduates studying, while the sixty-four "no" responses represent twenty-one percent of the non-students.

These numerous schools have only twenty-eight percent of the total graduates now studying, and seventy-nine percent of those not



studying. None of these communities has a secondary school, and only Jassos and Jaral are on a paved road. Of the nine schools with seventy-two percent of the graduates now studying, seven are on a paved road and all are within walking distance of a secondary school. All are close to or in the city of San Luis Potosi, or Soledad Diez Gutierrez. Not surprisingly, this proximity to a city seems to be the factor that most influences further studies. That is where the secondary schools are.

Boys are said to work more after graduation than do girls. This is probably due to the fact that many girls do domestic work; a boy who is working with his father is considered to be "working" while a girl helping her mother around the house is not so considered.

Both boys and girls, though, study in equal proportions after graduating from primary school. This shows up for both groups. Further studies do not seem to be the privilege of boys.

Girls who work move away in larger percentages than the boys, though considerably fewer girls work than do the boys. Girls can often work in the city homes as domestics.

Boys tend to come to the city less as the distance to the city increases, though for girls the proportions are reversed. This is probably from the nature of rural work and the definition of what work is in the more rural setting, as was just mentioned. A girl who moves away to do domestic work is classified as "working", but if she stays home to do the same type of work--though without pay--she is not thought to be working. A boy working with his father in the family field is not paid either, but evidently his contribution to the family is considered greater than his sister's, and he is considered to be "working".

We cannot conclude that we are finding that education decimates the countryside of its graduates. The teacher could only say for sure that ten percent of the graduates had left; they were not sure about the other seventeen percent.

### 9.3 Summary

Our results say that most of the primary graduates remain in the countryside. Coupled with our talks with the rural people in June and July, we are led to the conclusion that these slightly more educated people remain in a situation where their education is not of much practical value. They have received some education, but that education has not accomplished for them the one thing that education is seen to be for: to escape from the countryside. Until the years of education can be turned into rural benefits in the rural area, the dilemma remains: Should school cause a countryside-to-city brain drain, or should school produce educated rural people for a rural situation that cannot use that education? Were the teachers right who said that rural children with primary education should move to the city? Were the teachers wrong when

they said education has value for the rural area? The answers to both questions seem to be: "Yes." Rural children are receiving more education, but they cannot easily find a use for it.

## 10. REFLECTION

Radioprimeria is moving along haltingly. It is rarely supervised, but many teachers have shown ability to work with it on their own. It has not been set up in a way that lends itself to strict learning experiments, but the available data say that radio is doing a satisfactory teaching job--in comparison with what direct teaching is doing.

We have found that radio taught these children as well or better than direct teaching methods did. Spanish gain scores are very significantly better for the radio group. We found optimism about rural education among teachers, and pessimism about rural education among parents and employers. We did not find widespread benefits in the rural area from rural education. We found problems in radioprimeria's administration and problems in the hardware. We found a very complex system facing some very complex tasks. This section will be devoted to a discussion, based on what we found, about what the future of radio in rural Mexico might be.

Radioprimeria is more than a hardware system. It calls for support structures and an organization into which it can be fitted. The findings from this research bear out Faure's caution: "In many countries, the infrastructure needed to introduce modern technology does not exist. The cost of the investments required is prohibitive and it is impossible to train professional personnel and develop the facilities required in a short time. These constitute such serious obstacles to applying the most advanced techniques that the dazzling prospects opened up to developing countries, especially in education, risk being nothing more than a mirage, for a long while to come, generating possibly dangerous illusions" (p. 133). Mexico, being more advanced than most countries, will be better able to supply these investments. It is important that the administrators of radioprimeria be aware of the need for the infrastructure around which radioprimeria can take shape.

For the future, what direction should the Mexican authorities follow in their education efforts, and in their use of education technology?

### 10.1 Informal Use of the Media

First, might there be applications of educational technology on an informal basis? Areas such as agriculture, irrigation, health,

hygiene, and adult education in reading and writing deserve improvement. The effects of poverty in the rural areas could in some ways be overcome by the people themselves if they were more knowledgeable in basic things like preventive medicine. Could radio provide significant assistance to the rural people by informal broadcasts to adults?

Research on the effectiveness of the media is saying more and more that the media do not have their effects directly, or on individuals one by one. Twenty-five years ago, Lazarsfeld argued that the mass media are more effective when linked with pre-existing personal relations. Since then, his arguments have received more and more confirmation. Communication impact has come to be seen as a complex process of interaction among persons, some mediated, some face-to-face.

A social worker was living in one of the rural towns. Asked what the community needs were there, she did not mention the lack of water and electricity. She replied without hesitation that the problem there was a lack of organization and cooperation among the people. The people were not really a community, she said. If they are to come to grips with their physical needs at all, they have to work together--but they do not.

This lack of community structure is precisely the type of situation in which the mass media as an agent of social change are least effective. As long as the people are not organized in any way that could serve as the basis for a listening group, candor demands that the possibilities of informal adult radio programming be minimized. If within even a small community not everyone is aware that the radio is used in the school, it can be concluded that the personal communication networks in such a community are not strong, and would not form the substratum needed for an effective out-of-school broadcast. Even if the people did get beneficial ideas from the radio, community divisions could blunt any initiative. In one town visited, plans had long been made to have piped water at the school; engineers came and did some preliminary work. But personal divisions in the community prevented the project from being completed. The people are not trustful of one another or of innovations. An electric line runs past the same town but no one has tapped into it, partly because of the costs, partly because of community opposition to advances like that.

Before radio can be used informally to provide information, these divisions have to be overcome. Radio will not do it. It seems, realistically, that very little can be expected of radio for informal education and for social change in rural Mexico until the rural people have some kind of organization and mutual trust.

#### 10.2 Formal Use of the Media

If radio is to be used in rural Mexico now, it should link itself to the structures that exist, and the only fairly-organized

structure in rural San Luis Potosi is the school system. It has been seen that the school's problems stem particularly from the lack of organization that the system has, yet it is more organized than anything else in the countryside. A situation with no structure at all does not instill optimism in someone who has seen the problems with the organization of the schools. But, despite the problems, the schools seem to offer the best possibilities as a setting for educational technology. Radio should be tried mainly in the context of formal education because it is there that the most structure is available, and it should be in that structure that radio will have the most success.

SEP has the only structures reaching into the rural area and is therefore in the best position to use technology as a supplement to its work.

This brings up the more basic problem: Too much is expected of education. The development needs of Mexico are more broadly based than the emphasis on education implies. Thirty-five percent of this year's federal budget is going to SEP. While most of these expenditures will probably be made for urban schools, the pattern of thinking is that education--one factor--can be improved to the point where it will solve the many problems within Mexican society, particularly in the rural areas. It has been observed that already there is too much education and too little employment for even the present number of primary graduates, and that education has no practical value in the countryside. Yet despite all the problems and inadequacies of the school system as it stands, that system is still developed more than other social institutions and is producing more educated people than are needed by those other institutions. Obviously, the solution is not to cut back in the schools but to realize what the scope of development is and make efforts in other sectors of the society.

The great limitations in the job market became clear from the talks with factory personnel officers. The whole category "city work" is a lot more restricted than the rural primary graduates tend to think. Industrial development is therefore one sector that needs to grow. Even city people with primary education must compete in a tight job market. More education makes employment more probable, but not because the education is necessary to do the job; the employer just hires the best person he can get from the large pool of educated people.

Would it be a good idea to tailor the rural curriculum to rural needs? This question was put to the teachers. One hundred two teachers felt that the curriculum should be the same in the city and in the rural areas, while one hundred thirteen felt that there should be a different study program in the rural area. Possibly, a change in the rural curriculum that was geared to rural needs could change the whole conception of what education is for among the rural communities. If subjects could be studied and related directly to the rural reality, it might improve the life of the town and at the same time encourage



parents to allow their children to finish school. This represents a real option that radio primaria might consider; it relates to all rural school situations. It would be a basic change in the curriculum, but one that seems worth some further thought. Studies could first be made of the specific rural needs that curriculum should and could serve.

Rural development, particularly in the high desert country around San Luis, is a discouraging prospect. Water is the need; if it is possible at all, irrigation will be very expensive. Rural people themselves do not seem to think that rural life can be substantially improved. But there may be things that can be done for the rural areas: there are two agricultural schools in the rural parts of San Luis State--one in Tamuin and one in Villa de Reyes, both fairly far from the areas we visited. To go to these schools, you need to be a secondary graduate. Might this be a way to get more educated people back into the rural area and to contribute to rural development? The effect of these schools needs to be studied.

### 10.3 The Outlook

There are two Mexicos. The city and the countryside are two worlds. The middle-class people in the city, like the middle-class people in other countries, can live fairly well, insulated from the problems of the urban slums and the poverty of the countryside. Efforts like rural education, even rural education with radio, show up as quite meager when observed for a fairly extended period of time. It is not enough. It is not even close to being enough. The real need is for structural changes in the society that allow resources to be shared; now resources accumulate in the hands of a few urban people. The problem is many-faceted; the solution will have to be too. Better education represents only one facet of the answer.

With thirty-five percent of the federal budget going into education, is it realistic to ask for more or to ask that other sectors of the society get much greater emphasis than they do now? We really cannot say, and certainly the Mexican authorities can judge better than we can. One of the priorities that comes through, though, after a number of months in San Luis is that the people need more organization and trust in themselves. Until these elements exist in the rural communities, efforts in education, formal or informal, will suffer.

Perhaps the model of the radio schools used in Northeast Brazil in the early 1960s is the best to propose to Mexico. This experiment, whose rationale was developed by Paulo Freire, featured community-building and the creation of a political consciousness among the rural community. Until such a consciousness is formed, the rural people will not be effective in helping themselves nor will they be able to use well the help that may be offered to them from the city. The more basic question: do the authorities in the nation want the rural



people to develop a political consciousness and understand why their country runs as it does? In Brazil, the authorities did not want this and they closed down Freire's project.

The discussion of the use of the media to develop consciousness may be seen as an unwarranted tangent in an evaluation of instructional media. Instructional media and political education: how are they related? In fact, they are closely tied together and the evolution of communication theory has been moving inevitably toward such a relation. If the first two stages of communication theory may be summarized briefly, the first was the "hypodermic needle" theory that said that mass media affects the individual directly and automatically; and the second was the two-step, or multi-step, flow theory that said face-to-face communication is a necessary part of mass communication if the mass communication is to have its effect. The multi-step flow theory posits that personal interactions are crucial for media to be effective. If, however, personal interactions do not or cannot occur, the media will be ineffective. It becomes part of a communications theory, therefore, that personal interactions must be promoted for the mass media to do their job. Just as important as setting up technical facilities becomes the organization and supervision of the listening group. If the group is unable to receive and act on a message given by the media, if the group has no cohesion or community-sense--then communication theory must necessarily include political or consciousness formation, as an integral part of the communication process. This is particularly true when the media are being used to promote development through education. Underdevelopment and lack of political consciousness to help a person understand his underdevelopment and its causes contains contradictions. It is subject to the same type of critique made of the recent development reports: it ignores the structures that bring about underdevelopment.

Communication theory should contain more focus on the consciousness of the audience. Without it, an important aspect of the communication process is ignored and comes to light only after the process has begun. Perhaps a fuller communication theory could have contributed to Mexico.

For whatever reason, too much is being asked of rural education, too much is being asked of radio. Technology can sometimes aid in the solution of a problem; it can also serve to keep the problem at arm's length. Instead of sending people into the rural area to organize and educate and draw out the human resources that are there, technology is used--but it is not the same. True, radioprimeria was designed and implemented because the price of a direct teaching system was too high. While radioprimeria may educate as well as the direct teaching situation does, it has been observed to be far from a solution to the more basic problems of development. And in itself, to achieve even the limited objectives of rural education, radioprimeria needs more resources than it now receives.

The future is not bright, but perhaps the challenge of what development really is can now be better understood. The energy that Mexicans have put into radioprimeria is a hopeful sign that there is a real concern with the rural situation. But as the rural situation becomes more understood, its problems become more imposing and the efforts demanded of urban Mexico become more disturbing.

ii. UPDATE: MARCH 1975

Radioprimeria, now in its fifth year, has not expanded beyond San Luis Potosi. In the 1974-1975 school year, because of textbook changes occurring in the fourth and sixth grades, only fifth-graders are listening to the broadcasts. Mexico is re-doing the textbooks that are distributed nationwide, but the situation is expected to stabilize by September of 1975 for the coming school year.

Currently there are about 2,075 students fully involved with the radioprimeria programs. They are all fifth-graders, and they come from about 50 schools. These tend to be larger, more urban schools compared with the schools we studied in 1972. Since there continues to be a lack of supervision in the rural areas, principally because of the prohibitive cost of vehicles, the urban areas have gradually become the main setting for radioprimeria. While it may be a useful aid for these schools, radioprimeria was specifically created for the rural schools that lacked six grades. These problems are recognized by administrators in Mexico City; so far, they have been handicapped by a shortage of funds, but they are trying to improve the facilities for rural supervision in San Luis Potosi. The commitment to better supervision is seen as necessary if radioprimeria is to carry out the rural task that it was meant to do.

A new production group has introduced different formats into the radio lessons. Instead of a teacher talking over the radio, the lessons are now dramatized, with teachers and students acting out concrete learning situations over the air. The lessons are less abstract, and the students in the schools can identify with the students who are doing the broadcast. Furthermore, the classroom students are encouraged to participate more and make more responses to the radio lesson. This type of pedagogy may also have important effects on the teachers, whose training may not have stressed so much student involvement.

The Correo de Radioprimeria reflects the new format. One copy goes to every teacher, as before. Each class, however, also receives a copy for the students to review before the lessons so that two Correos are distributed to each classroom now, one for the teacher and one for the students. Also, each student receives four mimeographed sheets each week, containing, exercises for him to practice the lessons that have

been aired in that period. These sheets are collected for review by the administrators of radioprimeria after each teacher has reviewed them and signed them.

More than 115 schools ask to receive the Correo, even though only 65 of them listen to the broadcasts. Evidently, this printed material is useful for many teachers in the preparation and organization of their classes.

A very important change has been the installation of a one kilowatt transmitter at the university radio station. This allows radioprimeria to extend its reach to a 50-70 kilometer radius around the city, compared with the maximum of 30 kilometers possible with the previous 250-watt facility. Obviously, this power boost means that even more rural areas come into the potential signal area of radioprimeria and strengthens the argument for more supervision and utilization help for those areas. The experience of the last few years has demonstrated that radioprimeria needs more than an audible signal to be a viable addition to a rural school.

The question of curriculum remains unresolved. With Mexico's centralized education system, regional differences or urban-rural difference do not get the attention they might get in a more decentralized arrangement. In the radioprimeria project, a salient need was for lessons that related to the poor, rural situation where the students found themselves. This need is also recognized by the education authorities, but its implementation will demand major changes in the current education structure of the country. It cannot be expected that petroleum products will have an impact in the dusty, drafty schoolrooms of rural Mexico. Mexico has resources that most developing nations do not have, and could be the scene of unusual development gains.

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## CHAPTER IV

### PLANNING RADIO'S USE FOR FORMAL EDUCATION: METHODOLOGY AND APPLICATION TO INDONESIA\*

Dean T. Jamison and Joanne Leslie

This chapter deals with use of radio for formal instruction at the elementary level in Indonesia. Unlike the case studies in the volume, this chapter reports on a planning study of the potential for radio's use in Indonesia, rather than reporting on the operation of an ongoing system. The purpose of the chapter is to illustrate how planning studies can utilize evaluation information and, implicitly, to identify shortcomings in the evaluation literature that future research should address.

Section 1 of this chapter is a summary of overall findings. Section 2 discusses the existing elementary education system, and Section 3 discusses alternatives to it. Sections 4 and 5 discuss background information on attractive alternatives and provide estimates of their comparative performances and costs.

#### 1. SUMMARY

Its present (1971) system of elementary education is costing Indonesia between 20 and 30 thousand million rupiahs per year and it produces about 1.1 million graduates per year. The elementary school participation rate is approximately 63%, although a much smaller fraction of students than this actually graduate. For the most part, the quality of instruction is low, and this is partially manifested in high dropout and repetition rates, which result, in turn, in low efficiency. This low efficiency, combined with population pressure, suggests that if the present system is continued, real expenditures on elementary education would need to double between 1971 and 1980 simply to keep the participation rate from falling, even assuming that the rate of growth of salaries and construction costs could be held to 4% per year. If real expenditure increases were only able to cover real cost increases, the participation rate would fall to 51% by 1975 and to 42% by 1982.

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\*This chapter is based on a report prepared in 1971 for the UNESCO Mission assigned to the planning unit (Badan Pengembangan Pendidikan or BPP) of the Indonesian Ministry of Education. Data upon which the report was based were gathered at the BPP in April and May of 1971.

This presents a gloomy picture: if the present system is continued, there must inevitably be dramatic increases in expenditures or decreases in participation rates or both. It is natural, then, to examine a range of alternatives to the present system. Conventional options center around variations in teacher quality, class size, length of the student's school week, and intensity of classroom usage. The significant conventional options center around varying the overall student-to-teacher ratio by changing either class size or length of the student's school week. This chapter concludes that decreasing the student-to-teacher ratio from its present value of about 35 would decrease the number of graduates per year with a fixed level of expenditure; conversely, increasing the student-to-teacher ratio would increase output.

Another class of alternatives to the present system involves the use of some form of educational technology. The technological options in this study are arrayed along two dimensions -- type of technology and type of use. Cost considerations ruled out television and any form of instruction involving computers. The economies of scale of radio led to its being preferred to cassette distribution of audio for the scale of operation under consideration. Cost and development uncertainties associated with current knowledge of blackboard television and programmed learning led to postponing consideration of these technologies until more positive information became available. We conclude that radio is the most attractive of the technological alternatives.

Along the other dimension for arraying technologies, type of use, enrichment and total teacher replacement are rejected as being ineffective and infeasible, respectively. Substantial supplementation of the teachers' efforts in one or more subject matters appears attractive and various schemes for using radio to do this -- labeled Radio 2 through Radio 5 -- are described in Table 3. Substantial supplementation would also involve teacher training, but without necessitating the teacher's leaving the classroom.

The most attractive alternatives for elementary education that are analyzed in this chapter are: (1) introducing radio without increasing the student-to-teacher ratio (Radio 2 and Radio 3), and (2) introducing radio with a concomitant increase in the student-to-teacher ratio (Radio 4 and Radio 5). Radio 2 and Radio 4 involve substantial supplementation in one subject for every student; Radio 3 and Radio 5 involve substantial supplementation in two subjects. More detailed analysis of the cost and probable performance of the most attractive alternatives led to the conclusion that Radio 5 was likely the best of the radio alternatives; it has an estimated quantitative edge (in terms of numbers of graduates) on simply increasing the student-to-teacher ratio, and, perhaps more important, a significant quality advantage.

If Radio 5 were implemented, we estimate that cost per graduate of elementary school would decrease approximately 25% from what it would be with continuation of the present system. Table 7 shows the annual costs, conservatively computed, that would be required to implement Radio 5 over a 12-year period. The table assumes that the decision concerning whether or not to implement is made after the first 2 years, which would be devoted to development and evaluation. In the remaining ten years of implementation it is assumed that approximately 10% of the elementary schools would start using radio each years.

As Radio 5 assumes some substitution of capital for labor in the education sector, the introduction of Radio 5 would mean a less rapid increase in the stock of teachers than would otherwise be the case given the rate of growth of expenditure on elementary education. If, for example, real expenditures on elementary education were to increase at a rate of 6% per year for the next 12 years, something like 20% of the additional funds generated would be required to implement Radio 5 according to the schedule of Table 7. The remaining amount could be used to cover increases in teacher and construction costs and to increase the stock of teachers. In order to gain teacher acceptance, slight pay supplements could be given to teachers whose classes use radio; this pay increase would be an acknowledgement of the productivity gain radio would allow them through the increase in the number of students handled by each teacher.

## 2. THE PRESENT SYSTEM: COST AND PERFORMANCE

In order to place a discussion of alternatives into perspective, it is useful to project the performance of the present (1971) system into the future. Available data can be used to compute an annual drop-out rate of about 10% and an annual repetition rate of slightly over 10%. From these numbers, we have computed numbers of graduates per year as a function of available budget for elementary schools and per student costs. Assuming an average class size of 35 students, an average teacher salary (in 1968) of Rp. 57,300 per year, an average annual cost of classroom use of Rp. 23,000, and that on the average 1.5 classes use each classroom, the per-student annual cost in 1968 was Rp. 2070. <sup>1/</sup> (This compares reasonably well with Daroesman's (1971, 1972) survey data estimate of Rp. 2583; much of the difference comes from her estimate of Rp. 66,000 as the annual cost of a teacher.) The total expenditure on elementary education in 1968 is the product of Rp. 2070 and the enrollment of approximately 12,000,000 students -- i.e., about Rp. 24.8 billion. Table 1 shows the number of graduates as a function of time starting, with these 1968 base numbers and assuming no changes in the drop-out and repetition rates. (The growth rate of effective expenditures is the difference between the growth rate of expenditures in real terms and the growth rate of costs of educational inputs.)

TABLE 1

Numbers of Graduates of Elementary School, Present System<sup>a</sup>

| Year | Growth Rate of Effective Expenditures <sup>b</sup> |       |       |       |
|------|----------------------------------------------------|-------|-------|-------|
|      | -3%                                                | 0%    | 3%    | 6%    |
| 1970 | 1.130                                              | 1.114 | 1.099 | 1.085 |
| 1974 | 1.288                                              | 1.280 | 1.270 | 1.255 |
| 1978 | 1.148                                              | 1.280 | 1.420 | 1.567 |
| 1982 | 1.019                                              | 1.280 | 1.594 | 1.971 |

<sup>a</sup>Figures in the table are expressed in millions.

<sup>b</sup>The rate of growth of effective expenditures is defined to be the rate of growth of real expenditures minus the rate of growth of costs. These numbers are computed by the methods of Section 5.1.



Knowing the level of elementary school enrollment and the number of children aged 7 to 12, one can compute a gross participation rate for the system by dividing the second into the first. However, many of the individuals enrolled may actually be over 12, so a more appropriate measure is the number of students enrolled net of the number over 12; this number divided by the total number of children aged 7-12 is defined as "real" participation rate. The real participation rate can be computed from a knowledge of the drop-out rate, repetition rate, and rate of growth of enrollment; Table 2 shows projections of the real participation rate as a function of the growth rate of effective expenditures.

It is also possible, though slightly more complicated, to solve iteratively for the level of expenditures required to maintain the 1969 real participation rate of about 61% as a function of the rate of growth of real costs. If, for example, real costs increase at a 4% annual rate the real expenditures in 1982 will need to be more than double those for 1971 simply to prevent a decline in the participation rate. It is this rather discouraging conclusion that leads us to analyze alternatives to the present system.

### 3. ALTERNATIVES TO THE PRESENT SYSTEM

If a number of different techniques for providing elementary education exist, then at any given time a certain fraction (perhaps zero) of Indonesian students will be using each technique. An alternative at a point in time is a specification of the fraction of students using each technique at that time, and planning consists of comparing and evaluating various time streams of alternatives. In this section we will describe a variety of alternatives to the present technique for elementary education in Indonesia, which was discussed in the preceding section. We will leave it as understood that not only the techniques presented but any mix of them are possible alternatives.

We would like to make it clear that this section does not attempt to deal with all alternative activities for 7- to 12-year-old children. It focuses on what techniques elementary schools could use. Thus it does not consider such issues as: What fraction of students should be allowed to attend school? Should elementary school age be increased from 7-12 to 10-15 so that the economic benefits of education occur more quickly after the investment is made? Should the present curriculum emphases be continued? Should elementary schools be eliminated altogether and the children taught at home by media? A number of these are critically important questions, but they fall outside the scope of a cost-effectiveness analysis of alternative techniques for elementary education.

In this section, we will first describe the basic conventional alternatives, then the basic technological alternatives to the present system. Most of these alternatives are fairly clearly dominated by some

TABLE 2

Real Participation Rates as a Function of Time

| Year | Growth Rate of Effective Expenditures <sup>a</sup> |      |      |      |
|------|----------------------------------------------------|------|------|------|
|      | -3%                                                | 0%   | 3%   | 6%   |
| 1970 | .577                                               | .595 | .613 | .631 |
| 1974 | .454                                               | .529 | .613 | .708 |
| 1978 | .358                                               | .470 | .614 | .795 |
| 1982 | .282                                               | .418 | .614 | .892 |

<sup>a</sup>The rate of growth of effective expenditures is defined to be the rate of growth of real expenditures minus the rate of growth of costs.

other alternative and, after discussing the reasons for this, such alternatives are eliminated from further consideration. Section 4 presents more detailed cost and performance information on the more attractive alternatives. Section 5 uses this cost and performance information to project numbers of graduates and real participation rates into the future so that the more attractive alternatives can be compared to each other, and to the present system as described in Section 2.

### 3.1 Conventional Alternatives

The conventional alternatives to the present system fall into several relatively simple categories. These are:

1. Changes in teacher quality (i.e., level of intelligence, education, or experience).
2. Changes in the average number of students per class.
3. Changes in the average number of hours per week the student spends in school.
4. Changes in the utilization rate of classrooms.

The feasible alternatives can be characterized for any given annual budget for primary education,  $B$ , and number of students to be enrolled,  $N$ . Let  $q$  be a measure of teacher quality (for operational simplicity,  $q$  may have to be a simple measure such as percent of teachers fully qualified or average educational attainment of teachers) and let  $W(q)$  be the average annual wage (for full-time work) of teachers when their quality average is  $q$ . Let  $C$  be the average class size, i.e., the average number of students in a classroom with a teacher and let  $h$  be the average number of hours per week a student is in class. Assuming that a full-time teacher is in class 36 hours per week, the student-to-teacher ratio,  $S$ , is given by:

$$S = 36C/h. \quad (3.1)$$

Increasing class size thus increases  $S$ , as does decreasing  $h$ .

To continue, let  $U$  be the average usage rate of classrooms, i.e., the average number of times they are used per day and let  $P$  be the annual price for a classroom. Since the available budget was  $B$  and the number of students was  $N$ , an average of  $B/N$  rupiahs per student per year is the basic cost constraint. Each student consumes  $1/S$  or  $h/36C$  teachers and  $1/UC$  classrooms during the year. Thus the following generalization must hold:

$$N(h/36C)W(q) + P/UC = B. \quad (3.2)$$

Equation 3.2 summarizes all "conventional" alternatives for the elementary school system in broadbrush terms. It fails to capture nuances but it specifies, nonetheless, all combinations of teacher quality, class size, hours of class per week, classroom usage rate, and students enrolled that are possible at the prevailing budget, prices, and wages.

If educational research were to the point where planners had functions relating school performance measures (e.g., the drop-out rate and the repetition rate) to C, q, h, and U, it would become a relatively simple mathematical problem to maximize number of graduates per year, say, subject to a budget constraint of B rupiahs per year; however, educational research is nowhere near this point. Thus, the approach that will be taken later is to choose several values of the control variables that vary in different directions from the present values, then to estimate the consequences for enrollments and graduates. This gives an idea of the direction in which planners should be moving, even if it fails to say how far they should go.

### 3.2 Technological Alternatives

It is somewhat more difficult to categorize the technological alternatives than to categorize the conventional ones. There seem to be broad dimensions along which the alternatives can be arrayed. The first is alternative technologies and the second is alternative uses for technology. Alternative technologies include:

1. Television.
2. Blackboard television, i.e., television that presents only alphanumeric characters or line drawings.
3. Classroom controlled audio-visual media, including tape cassette players.
4. Radio.
5. Computer-assisted and computer-managed instruction (CAI and CMI; with CAI the student is on-line to the computer, with CMI he is off-line).
6. Programmed self-instruction.

Alternative uses for technology include at least the following five possibilities:

1. Enrichment of learning, i.e., provision of occasional lessons or experiences that the classroom teacher cannot easily provide.
2. Total replacement of the teacher in one or more subject areas.

3. Substantial supplementation of the teacher in one or more subject areas.
4. Teacher training.
5. A simultaneous mix of 3 and 4.

Schramm, Coombs, Kahnert, and Lyle (1967) review instances where new media have been used for many of these tasks, as well as for out-of-school education. In a more recent paper, Jamison, Suppes, and Wells (1974) examine the effectiveness of a variety of instructional media.

Since six technologies were listed, and five alternative ways of using technology, there are a total of 30 broad "technological alternatives". However, after brief consideration, most of these appear unattractive and the next sub-section sharply reduces this rather extensive list of alternatives.

### 3.3 Elimination of Less Desirable Alternatives.

Less Desirable Technological Alternatives. A basic source of information on the performance of the new media, and to a lesser extent their relative costs, is Learning from Television: What the Research Says by G. Chu and W. Schramm (1967). Chapter VI of that volume deals with studies of media other than television. Somewhat more detailed cost studies may be found, for past projects, in Schramm, Coombs, Kahnert, and Lyle (1967) and in its accompanying three volumes of case studies. Our analysis at this point draws heavily on these previous findings.

Chu and Schramm record hundreds of instances where television teaches as well or better than a well-trained classroom teacher, in addition to a number of instances where it fails to do as well. Television appears to work relatively better for elementary students than for older ones and there seems to be no doubt that television could effectively teach in the elementary schools of Indonesia. However, television is expensive -- perhaps five times as expensive as radio (Jamison, Klees, and Wells, 1976, pp. 88-93) -- and, except where moving pictures are essential, radio appears to teach about as well. For reason of its much higher cost than radio, television seems to be an unviable alternative for elementary education in Indonesia, at least for the near future. However, it does appear that transmission costs can be made much lower than they are today - see Bourret (1971) -- and there may come a time when sufficient funds are available for Indonesian elementary education to include selective use of television. It is also possible that more sophisticated future work on the comparative effectiveness of different media for different tasks will define areas where television is more cost-effective.

Blackboard television is a technique under development by Dr. Iskandar Alisjahbana of the Bandung Technological Institute (I.T.B.) with colleagues from Holland. Its major attraction is that its video



signal can be transmitted over a voice-grade circuit; a disadvantage is that it requires a modification to an ordinary television set that may be costly. As blackboard television is still under development, and its production costs remain uncertain, it cannot be considered an active contender for operational use at the moment. It appears sufficiently promising, nonetheless, that further development at I.T.B. should be encouraged.

For many purposes, classroom controlled audio-visual media appear potentially attractive. Films teach about as well as television and, though there is less evidence for this, it is reasonable to conjecture that cassette tapes would teach as well as radio. The critical point for comparing these alternatives to broadcast alternatives, appears to be the question of economies of scale. Chu and Schramm cite a study of the French Bureau d'Etudes ORTF (1964) indicating that over-the-air transmission of audio was less costly than disc distribution for audiences over about 3000. Presumably the break-even number in Indonesia would be considerably less since, due to poorer transportation in Indonesia than in France, each location would require considerably larger inventories of recorded material, which would in turn sharply increase costs. Classroom audio-visual media are discussed at greater length in M. Jamison (1967) and may have a potentially valuable role to play for higher levels of education in urban areas. However, the economies of scale issue would seem to rule them out for mass use at the elementary level.

Fourth on the list of alternative technologies to be considered is radio. In terms of both cost and performance for large audiences, radio is attractive. Section 4 contains more detailed performance information concerning radio as well as total, average, and marginal cost equations for its use under several sets of assumptions.

Jamison, Fletcher, Suppes, and Atkinson (1976) present evidence that computer-assisted instruction (CAI) is becoming an attractive educational alternative for developed countries, but the cost figures in their paper completely rule out CAI for operational use in Indonesia in the near future. Computer-managed instruction (CMI) is considerably less expensive; Jamison and Ball (1971) have suggested that it is potentially capable of being distributed by satellite at night to quite dispersed and remote areas. Nonetheless, per-student annual costs of a minimum of \$10 to \$15 per subject matter indicate that CMI is not yet to the point where it could be seriously considered for operational use in Indonesia.

In a review of the literature on programmed instruction, Schramm (1964) concludes that programmed self-instruction can teach effectively; research available to him at that time was almost entirely conducted in developed countries. Roebuck (1969) reports on an experiment involving programmed instruction that took place in Nigeria. He concludes that programmed texts were successful teaching devices with some students, but that coordination of students at different points

caused considerable administrative difficulty. We have no information available concerning the cost of programmed instruction, although fairly good estimates of part of the cost could be made if the number of pages covered per day were known. We would conclude that programmed instruction is potentially somewhat attractive but probably costly and difficult to implement on a large scale. Partially for lack of data and partially because it seems very likely to be instructionally inferior to radio, programmed instruction is not considered further in this chapter. However, more consideration should probably be given this possibility.

We will now turn to consideration of alternative ways of using the technologies. The first two that were listed -- enrichment and complete replacement of the teacher -- will be considered only briefly. Rather than a serious alternative to the present system, enrichment would tend to provide only a minor change, although potentially a somewhat costly one. Complete replacement of the teacher falls at the other end of the scale. The possibility that there would be no need for individuals in the classroom with approximately the level of training of present-day primary teachers would seem to be both pedagogically and politically improbable.

Substantial supplementation of the classroom teacher, on the other hand, seems entirely feasible. The medium could take most of the burden of instruction - in a small number of subjects - while the teacher would assist individual students, grade papers, and acquire more training herself. For this last reason, little real difference exists between this alternative and the last use listed, substantial supplementation plus teacher training. If a medium is used for substantial supplementation, increasing class size or reducing the number of hours in the student's school week would lead to reductions in teacher requirements. This would be true even though the teacher remains in the classroom during all broadcasts, both to supervise the children and for teacher training.

A final use of the medium would be for the sole purpose of improving teacher quality and only through that means influencing student performance. This possibility has been analyzed for Indonesia in a BPP study by Miarso (1971), which compares use of radio to conventional means for upgrading teachers. Miarso's results will be further analyzed in Section 5, which looks in more detail at attractive alternatives; the use of radio that he studies will be labeled Radio 1.

This completes the initial analysis of the technological alternatives. Radio emerges as the most attractive technology and the most attractive uses appear to be for teacher training (Radio 1) or for substantial supplementation of the teacher plus teacher training. Four explicit ways of using radio for substantial supplementation will be analyzed in the following sections and these are labeled Radio 2 through Radio 5. Table 3 describes these 5 uses of radio in more detail. While these uses clearly represent only a few of the logical possibilities, we consider them representative of the major alternatives. Now we will return to the conventional alternatives.

TABLE 3

Uses for Radio in Elementary Education<sup>a</sup>

| Label   | Description <sup>a</sup>                                                                                                                                                                                                                                                                                                   |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Radio 1 | This alternative is described in detail in Miarso (1970) and involves short term (1 to 3 week) workshops for teacher upgrading. Workshops would use radio and/or recorded audio instruction.                                                                                                                               |
| Radio 2 | This alternative would leave unchanged all aspects of the present system except that in one subject matter there would be a 20-30 minute daily broadcast at each grade level. The purpose of this broadcast would be to supplement the teacher's presentation in that subject substantially and to help train the teacher. |
| Radio 3 | This would be the same as Radio 2 that there would be daily broadcasts in two subject matters instead of one.                                                                                                                                                                                                              |
| Radio 4 | This would be the same as Radio 2 except that the school day would be shortened to four hours for all students to allow for double shifts. The resulting increase in the ratio of the number of students in the system to the number of teachers would help cover the cost of introducing radio.                           |
| Radio 5 | This would be the same as Radio 4 except that there would be daily broadcasts in two subject matters instead of one.                                                                                                                                                                                                       |

<sup>a</sup>This table describes the radio alternatives whose cost and performance are analyzed in more detail in the text. Clearly these are not the only ways to use radio; they are, in fact, somewhat conservative in that it is at least conceivable that many more subject matters could be taught. Also, radio could be introduced with much more radical changes in average student-to-teacher ratio than considered here. The purpose of detailed examination of these particular radio alternatives is to ascertain the consequences of promising, and feasible steps in several different directions.

Less Desirable Conventional Alternatives. The various conventional alternatives appear implicitly in equation 3.2. The first variable to consider is that of teacher quality, the importance of which has been stressed by Beeby (1966). Unfortunately, using conventional means to change significantly the average quality of so large a teaching force as Indonesia's would be enormously costly, take much time (Beeby measures it in generations), and might oblige many teachers to leave their posts unfilled for significant periods. As mentioned before, less significant changes in teacher quality are examined in more detail later, assuming both conventional retraining and Radio 1.

The second conventional variable is class size. This variable is critically significant due to its impact on cost. A number of studies examining the impact of class size on student performance will be reviewed in Section 4, and the probable effect of changed class size on numbers of graduates of the elementary system is examined in Section 5.

The third conventional variable is number of hours in the student's school week. This, along with class size, determines the average student-to-teacher ratio and is equally significant in terms of costs. We were able to find less evidence concerning the impact of this variable on performance, but Bennett (1971) argues "... one hard fact to be borne in mind is that very few people in developing rural areas in Africa (and probably elsewhere too) work a full day anyway. This is partly due to tradition but, more significantly, to worms, dysentery and malnutrition. ... there is little objective evidence to show whether much extra is taught in insisting that the underfed children remain in their classrooms six hours a day instead of three or four hours." The impact on performance of this variable is examined in Section 5 along with class size through their joint impact on the student-to-teacher ratio.

A final variable is that of classroom utilization. In order to minimize per-student costs it is clearly desirable to increase to the maximum possible the number of hours per day a classroom is used. The feasibility of doing this depends very much on the number of hours per week that classes meet. If the average is four-and-a-half hours per day or less, double shifting is probably possible; otherwise, it might be difficult. Classroom utilization is already good in Indonesia -- Slors (1971) and "Beberapa Alternatif..." indicate 1.5 classes per classroom -- but it would seem desirable to push this closer to 2. The cost implications of this, which are included in the analysis of Radio 4 and Radio 5, are not large but are nonetheless significant, and become more so if class buildings only last 15 or 20 years instead of the assumed 50.



#### 4. PERFORMANCE AND COST DATA FOR ATTRACTIVE ALTERNATIVES

In this section basic performance information concerning radio will be presented, then data concerning the impact of class size on student achievement will be given. After presenting the performance information, we provide estimates of the total, average, and marginal cost equations for several ways of using radio. These rupiah costs can then be translated into costs in terms of required increases in student-to-teacher ratios necessary to keep per-student costs constant, and these calculations are shown. Costs of the conventional alternatives were already discussed in Section 2.

##### 4.1 Performance of Radio

The preceding section concluded that radio appears to be the most attractive technological alternative for Indonesia at the present time. We provide further support for that conclusion here. First we will give an overview of other countries' experiences, then a survey of comparisons of radio and television.

Experiences with Radio. A complete survey of instructional radio projects would be impossible; part of the reason is that many small-scale, short-term projects, which were brought into being and supported solely by local initiative. In such projects all the available resources are needed for running the programs; there is rarely time or energy to spare for documenting the effort. However, even a complete list of instructional radio projects on which we do have information would become tedious. Instead, we attempt to describe enough different projects to give a good idea of the range of uses to which instructional radio has been put so far. While the United States is not a leading country today in the use of instructional radio, important pioneering work in sound broadcasting to schools was done in the United States before World War II.

In Chicago, in the 1932-33 school year, two 15-minute lessons were broadcast by radio each day to the schools. Then in 1937, radio played a dramatic role in the Chicago public school system. Due to a polio epidemic the schools were unable to open for several weeks in the fall. Lessons for the third through the eighth grades were broadcast for two hours in the mornings and two hours in the afternoons. Newspapers cooperated by printing daily guides and worksheets which included summaries of the lessons, directions, questions, and assignments. It is estimated that 315,000 children listened to these lessons. The Chicago school directors were so impressed with the success of this project that they continued broadcasting some lessons even after the schools reopened -- Atkinson (1942; pp. 37-45).

An interesting and successful attempt to use radio in schools took place in Oakland, California in the late 1920's. In this project,



radio broadcasts were actually used instead of teachers for many subjects in the fifth through the tenth grades. The lessons in the Oakland radio project were 20 minutes long, but the first four or five minutes were simply music. It was found that frequently this much time was necessary to get the class ready and to tune the sets. It was found that the lessons were most successful if (1) instructions were clear, (2) sufficient time was given for the students to carry out directions, and (3) important ideas and directions were repeated. There was a strong emphasis on student participation during the lessons. Test results showed no differences in performance between radio classes and classes receiving the same lessons from a teacher. See Dickson (1926).

Another country that makes widespread use of instructional radio is Japan. In 1936, NHK, Nippon Hoso Kyokai (Japan Broadcasting Corporation) began a small program of radio broadcasts to the school. After World War II, a decision was taken to modernize the Japanese educational system, completely, both in terms of curriculum and in terms of teaching techniques. Radio played an important role in this modernization, both in compensating for the many textbooks lost during the war and in allowing rapid dissemination of the new methods of instruction. A survey done in 1958 by the Broadcasting Culture Research Institute of the NHK reported that 45 percent of primary schools, 37 per cent of lower secondary schools, and 27 per cent of upper secondary schools made regular use of radio broadcasts. In Japan it is possible to receive a secondary level diploma without spending any time in a classroom through a combined program of correspondence courses and radio lessons. See NHK (1964).

More relevant for Indonesia, are recent experiments with instructional radio in the developing countries. While a number of these examples involve out-of-school education for adults, they are discussed here to illustrate that radio can be an effective instructional medium in developing countries.

School broadcasting in Thailand began in 1958, and is described in Schramm, et al (case studies, 1967). For the first four grades there were radio lessons in social studies and music, and for the fifth grade, English. The original experimental group was 286 schools; by 1965 this had expanded to 5,000 schools. In 1960 the radio classes were compared with a control group consisting of schools that were similar except for the absence of radio instruction. Grades two and three were compared in music, grades six and seven in English. For grades two and three, the radio group's average performance was significantly better than that of the control group. For grades six and seven, the radio group performed better on reading and writing tests, although no significant differences were found in oral tests between the two groups. It should be noted that the control groups were probably at some disadvantage as these particular subjects were chosen for radio instruction because they were not otherwise easily available in the schools.

Radio is used quite extensively for adult education in Tanzania. In the early 1960's, the Adult Education Service (AES) was established; a major part of the AES effort centers around the combined use of radio broadcasts and correspondence courses. Dodds and Masewe (1969) report that 60 per cent of primary schools in Tanzania have a radio available, so in most locations the primary school has become the AES center and the primary school-teacher has taken on additional responsibilities as the adult education leader. In 1969 there were about 60 radio groups operating. ETV has not been considered as an alternative because there is no plan to allow television into Tanzania. For a more recent discussion of radio education in Tanzania see the chapter in this volume by Hall and Dodds.

Radio is used in Kenya both to provide secondary level schooling in rural areas and to provide in-service training for teachers. As in Tanzania, the project in Kenya uses both radio and correspondence courses to provide instruction. The radio/correspondence courses are expected to increase the percentage of the eligible age group that can obtain a secondary education from 3 percent to 13 percent. In addition to school-leavers, unqualified primary schoolteachers are a prime target of radio correspondence education. The results thus far indicate that the radio students do as well or better than those in teacher-training colleges and better than those who try to study on their own. The chapter in this volume by Kinyanjui discusses this project in more detail.

We will now look at two examples of instructional radio in Latin America. One of the most widespread and best-known uses of educational radio in Latin America is Radio Sutatenza in Colombia. See Ozeata (1960). In 1947 Father Jose Joaquin Salcedo went to help the parish priest of Sutatenza and decided to provide basic literacy lessons and health information to the rural workers by radio. His first attempts to use radio by itself to teach reading and writing were disappointing. But then it was discovered that a man who could only just read and write was able to act as an intermediary between the radio teacher and the student, without having to do any teaching himself. Once the success of this method was discovered, the subjects taught were expanded to include arithmetic, religion, and agricultural education.

Radio Sutatenza had five transmitters in 1960. By 1963 there were 300,000 students enrolled in radiophonic schools in Colombia. There were two types of learning groups: (1) the radio school run by "auxiliaries" or monitors who are usually young people with two months of training, and (2) family radio schools without any kind of monitor. These latter are quite common in the areas with widely dispersed populations. If a rural worker or group of workers could obtain a receiver, the ACPO (Popular Culture Movement) would supply printed material and writing sheets free. According to Nitsch (1964), participation is also facilitated by the fact that lessons are broadcast four different times during the day.

Mexico has begun teaching the last three years of elementary school by radio. The program was originally created for school dropouts in Mexico City, and is now being tried on a larger scale in rural Mexico. The program is intended for two groups of students: (1) school-age children who live in areas where only the first, second, and third years of primary school are available, and (2) adults over the age of 15 who did not finish their primary schooling and who now wish to do so. Most of the radio lessons are planned for all three grades to hear simultaneously. Pupil booklets are provided for all students at the appropriate grade level. After the broadcast, each student works on related programs at his own level. The Mexican Ministry of Education has made a preliminary evaluation of this program based on teachers' observations, examination of student booklets, and student attitudes. They report that the radio students are learning as well as those in regular schools -- see Radioprimaria (1970) and for a more recent evaluation of the program, the chapter in this volume by Spain.

Instructional Radio and Instructional Television. Unfortunately the literature in the field of educational technology reports on little research into the relative effectiveness of the different media as instructional tools. For the most part, wherever technology has been introduced into an educational system, funds have not been sufficient to allow experimentation with more than one medium. However, a few comparisons of instructional radio and instructional TV have been made. These comparisons, too, support the view that radio can be effectively used in the schools.

Educators involved with many radio teaching projects have discovered that the provision of visual materials and writing sheets greatly increases the effectiveness of radio lessons. Skornia (1962) reports that in Holland and the Scandinavian nations, radio has been found to be better than TV for teaching various subjects when used simultaneously with exercise manuals and other student participation materials. These participation materials cannot be used as effectively with TV because a division of attention between the screen and the printed page is required. Though these experiments tend to indicate that radio may be capable of teaching almost as well as TV, several further points should be borne in mind. First, TV could have a stronger impact on motivation and, second, TV now appears to be more effectively used in the classroom than it was in the past. Nevertheless, for Indonesia, the great difference in cost would seem to be the overriding consideration.

#### 4.2 Effect of Class Size on Student Achievement

A popular and persistent belief in the educational tradition of Europe (and in a number of non-European countries that based their educational systems on a European model) is that teaching is more effective in small rather than large classes. Historical justification for this belief comes from a statement by a rabbi of the third century that there should be no more than 25 students enrolled in one class

(mentioned in Eurich, 1956). Many experiments and research projects in the last 50 years have attempted to determine whether small classes are actually more effective than large classes. While some of the findings of that by now substantial research literature conflict with other findings, it is a reasonably clear pattern in the literature that class size variations, in the range studied, will tend to have little impact on student cognitive performance (see Jamison, Suppes, and Wells, 1974, for an overview).

#### 4.3 Cost of Educational Radio

This subsection will first state the basic assumptions concerning component costs; it will then combine these component costs in ways that are most useful for economic analysis -- i.e., into total, average (or unit), and marginal cost curves. For a more detailed discussion of instructional radio costs and methods for analyzing them, see Jamison, Klees, and Wells (1976).

Component Costs of Radio. The analysis will deal with five basic components of the cost of providing educational radio -- programming costs, book costs, receiver costs, transmitter costs, and teacher-training costs. The purpose of the analysis is not to further refine engineering cost estimates but to combine generally available, though occasionally slightly inaccurate, numbers into a meaningful picture of total cost.

Our programming cost estimates come from detailed proposal prepared by Stanford University's Institute for Mathematical Studies in the Social Sciences to the United States Agency for International Development. These costs include both the preparation of the audio tapes for broadcast and the cost of writing the accompanying printed material. The purpose of the proposal was, among other things, to program curriculum for teaching arithmetic by radio in a developing country for grades 1 through 6. The cost was high in order to allow carefully controlled curriculum development based on continual analysis of student response to the instruction. A cost of \$75,000 per course year (or \$450,000 for the six years) emerges as the best estimate from that proposal, and that is the number we shall use here. It should be stressed, however, that this cost estimate is a very conservative one indeed; Radio Republic Indonesia, for example, currently estimates the cost of its educational programming to be about \$60 per hour, or less than \$10,000 for a year-long course segment. Much of the difference probably lies in the iterative development and evaluation cycle proposed by the Stanford group. In order to assure quality programming for mass usage, the development effort is likely worthwhile -- and it is also a mechanism for gradual implementation. Given this development effort, however, the program will be assumed to last 12 years.

The second component of cost to be considered is that of printed material for the students. For about \$.0033 per page, technology now in use in Indonesia can produce books with a 3-year lifetime under moderate student use. New techniques using semiplasticized paper



are becoming available that should extend lifetime at this level of usage to 5 or 10 years and perhaps slightly reduce costs. In this chapter the expected costs are assumed to be \$.0025 per page with a 5-year lifetime. With this estimate, as with all the component cost estimates, the cost equations will also be derived for a high cost case assuming 1.5 times these costs and for a low cost case assuming .65 times these costs.

The next cost area is that of receivers. Typical prices for commercial receivers at an electronics store in Jogjakarta in May, 1971, ranged from Rp. 3000 for a Golinda Junior III operating between 40 and 140 meters to Rp. 13,300 for a portable Philips 16RL377 with three separate short wave bands. As it is extremely difficult to separate costs from price when tariffs separate markets from the international economy, we simply use \$20 as a representative international price for an excellent battery-operated receiver.

The next cost component is that of transmitters. Detailed cost estimates here must await the decisions concerning medium wave versus short wave versus FM as well as the results of more detailed transmission studies. Nevertheless it is possible to place an approximate upper bound on these costs by using a cost of \$5000 for a low power, one-man-operated transmitter with a radius of approximately 7 miles (11.5 kilometers). About 400 such transmitters are in use in the United States today (in the FM band). Likely it will be possible to economize by placing much larger transmitters in some locations, so this estimate is conservative. Our estimates here are also conservative in that each transmitter is only assumed to reach 80% of the students in the schools that it covers and that the average population reached by a transmitter is assumed to be only half that the population density of Java-Madura would indicate (if the transmission facilities were used for other forms of in-school education or for out-of-school education, as well as for the primary school uses, then only a fraction of the cost of the transmitter should be charged to primary school use.) The transmitter is assumed to last 10 years and to have an annual maintenance and operating cost of 10% of its purchase price.

Finally, in order to implement radio, a certain amount of teacher training and orientation will likely be required. This is assumed to cost \$10 per teacher (\$15 per teacher for training in two courses), and to be good for ten years since, from an initial point on, the teacher will be learning from the radio.

The above, then, are the basic cost components that will be used in the following analysis. The estimates are believed to be conservative estimates of the state of the art and higher and lower variations are also provided. If, however, anyone sharply disagrees with any of the cost assumptions, the following analysis is structured in such a way that he can easily examine the consequences of his own assumptions.

Total, Average, and Marginal Cost Curves. In the following section, four different specific alternatives for using radio for substantial supplementation plus teacher training will be analyzed. The first two, Radio 2 and Radio 3 add radio -- for one subject matter and two subject matters, respectively -- with no increase in student-to-teacher ratio to compensate for the cost. Radio 4 and Radio 5 are alternatives that increase the student to teacher ratio by putting students in grades 3 through 6 on 4-hour shifts without increasing class size. (Most students in grades 1 and 2 are already on shifts). This also allows for improved classroom utilization. Radio 4 parallels Radio 2 in providing substantial supplementation in a single subject matter; Radio 5 has it for two. We presume the two subjects would be Bahasa Indonesian and arithmetic.

All cost equations in this section will be stated in annualized terms. This means that all capital costs, such as programming, must be translated into annual equivalents by the factor  $a(r,n) = (r(1+r)^n) / ((1+r)^n - 1)$  times the capital cost. Here  $r$  reflects the cost of capital and a figure of .15 is used throughout to reflect the high social cost of capital in Indonesia today.  $n$  is the expected useful lifetime of the capital outlay; the values of  $n$  appeared in the text describing each cost component.

Three cost concepts are used.  $T(N)$  is the total annual cost for a way of using radio if  $N$  students use the system.  $T(N)$  increases as  $N$  increases.  $A(N)$  is the average annual cost, or unit cost and is defined to equal  $T(N)/N$ . Due to the fixed programming costs,  $A(N)$  declines to an asymptotic value as  $N$  increases. The third cost concept is that of marginal or incremental annual cost,  $M(N)$ ; this is the annual cost per student of adding new students to a system already in operation.  $M(N)$  is equal to the derivative of  $T(N)$  with respect to  $N$  and simply assumes a constant value in the present cost model. In the next paragraph, total cost curves for Radio 2 through Radio 5 are presented; average and marginal cost curves follow from them. In all cases 150 pages of printed material per student per year are assumed to be required for each course (i.e., 150 pages per year are required for Radio 2 and Radio 4, 300 pages per year are required for Radio 3 and Radio 5.

The total cost of Radio 2 will be designated  $T_2(N)$ , for Radio 3,  $T_3(N)$ , etc. These equations are expressed in terms of the following variables, whose values were justified in the text.

$T$  = transmitter cost = U.S. \$5000

$R$  = receiver cost = U.S. \$20

$B$  = book cost = U.S. \$.0025 per page

$P$  = programming cost = U.S. \$75,000 per course year

W = teacher workshop cost = \$10. for Radio 2 and 4, but \$15.  
for Radi 3 and 5

The total cost curves follow:

$$T_2(N) = a(.15,12)6P + a(.15,5)150NB + a(.15,5)NR/70 + (.1+a(.15,10)NT/9375 + a(.15,10)NW/35 . \quad (4.1)$$

$$T_3(N) = a(.15,12)12P + a(.15,5)300NB + a(.15,5)NR + (.1+a(.15,10)NT/9375 + a(.15,10)NW/35 . \quad (4.2)$$

$$T_4(N) = a(.15,12)6P + a(.15,5)150NB + a(.15,5)NR/105 + (.1+a(.15,10)NT/9375 + a(.15,10)NW/52.5 . \quad (4.3)$$

$$T_5(N) = a(.15,12)12P + a(.15,5)300NB + a(.15,5)NR/52.5 + (.1+a(.15,10))NT/93.75 + a(.15,10)NW/52.5 . \quad (4.4)$$

A few notes are in order concerning the construction of these formulae. The source of programming and book costs is fairly clear. For Radio 2, two classes share a receiver; for Radio 3, one class; for Radio 4, three classes (possible because of shifting); for Radio 5, one and a half classes. The .1 appearing in the transmitter cost term is to allow for operations and maintenance. The transmitter term is the same for all uses, though transmitter utilization would vary from 3 hours per day with Radio 2 to 6 or more hours per day for Radio 5, the exact number depending on how the shifting is done. Radio 2 thus leaves more free air time for out of school education, entertainment, or other formal educational uses. (It is in keeping with our policy of conservative cost estimation that the full transmitter cost is charged to the primary school use).

Table 4 shows expected, high and low total cost equations for each radio alternative. Expected costs are computed from the values of T, R, B, P, and W shown above; high costs equal 1.5 times expected costs; low costs equal .65 times expected costs. The unit cost equations and values of the marginal costs are shown in Tables 5 and 6.

The costs shown in Tables 4 to 6 are all effective annual costs in which capital costs are spread over their useful lifetime with an assumed social cost of capital of 15%. While the annualized costs give a more accurate representation of the "true" annual costs, it is also valuable to show actual expenditures required, by category and by year. The information in equations 4 to 7, and in the cost figures preceding these equations is sufficient to determine these costs, if a specific pattern of implementation is assumed. The costs per year of implementing Radio 5 are shown in Table 7, under the assumption that the

TABLE 4

Total Annual Cost Formulas<sup>a,b</sup>

|                | Programming | Printed<br>Material | Receiver  | Transmitter | Teacher<br>Training |
|----------------|-------------|---------------------|-----------|-------------|---------------------|
| <u>Radio 2</u> |             |                     |           |             |                     |
| Expected       | 28,225,530  | + 38.035N           | + 28.979N | + 54.264N   | + 19.356N           |
| High           | 42,338,300  | + 57.053N           | + 43.469N | + 81.397N   | + 29.034N           |
| Low            | 18,346,590  | + 24.723N           | + 18.837N | + 35.272N   | + 12.581N           |
| <u>Radio 3</u> |             |                     |           |             |                     |
| Expected       | 56,451.130  | + 76.071N           | + 57.959N | + 54.264N   | + 29.034N           |
| High           | 84,676,700  | + 114.106N          | + 86.938N | + 81.397N   | + 43.551N           |
| Low            | 36,693,230  | + 49.446N           | + 37.673N | + 35.272N   | + 18.872N           |
| <u>Radio 4</u> |             |                     |           |             |                     |
| Expected       | 28,225.530  | + 38.035N           | + 19.320N | + 54.264N   | + 12.904N           |
| High           | 42,338,300  | + 57.053N           | + 28.979N | + 81.397N   | + 19.356N           |
| Low            | 18,346,590  | + 24.723N           | + 12.558N | + 35.272N   | + 8.388N            |
| <u>Radio 5</u> |             |                     |           |             |                     |
| Expected       | 56,451,150  | + 76.071N           | + 38.639N | + 54.264N   | + 19.356N           |
| High           | 84,676,720  | + 114.106N          | + 57.959N | + 81.397N   | + 29.034N           |
| Low            | 36,693,230  | + 49.446N           | + 25.115N | + 35.272N   | + 12.581N           |

<sup>a</sup> Costs are in 1970 rupiahs, converted from dollars at Rp. 340 per US dollar.

<sup>b</sup> For any value of N, the number of students in all grades using the system, the sum across the row shows the total annual cost of providing radio for all the students. Capital costs are converted to annual costs on the basis of their expected lifetime and a social cost of capital of 15%.



TABLE 5

Average Annual Cost Formulas<sup>a</sup>

|                |                |           |
|----------------|----------------|-----------|
| <u>Radio 2</u> |                |           |
| Expected       | $28,225,530/N$ | + 140.634 |
| High           | $42,338,300/N$ | + 210.953 |
| Low            | $27,519,880/N$ | + 91.413  |
| <u>Radio 3</u> |                |           |
| Expected       | $56,451,130/N$ | + 217.318 |
| High           | $84,676,700/N$ | + 325.992 |
| Low            | $55,039,840/N$ | + 141.263 |
| <u>Radio 4</u> |                |           |
| Expected       | $28,225,530/N$ | + 124.523 |
| High           | $42,338,300/N$ | + 186.785 |
| Low            | $27,519,880/N$ | + 80.941  |
| <u>Radio 5</u> |                |           |
| Expected       | $56,451,150/N$ | + 188.330 |
| High           | $84,676,720/N$ | + 282.496 |
| Low            | $55,039,850/N$ | + 122.414 |

<sup>a</sup> Average annual cost is total annual costs, Table 3. divided by the number of students, N. These are commonly called unit costs. Costs are in rupiahs.

TABLE 6

| Annual Marginal Cost <sup>a</sup> |         |         |         |         |
|-----------------------------------|---------|---------|---------|---------|
|                                   | Radio 2 | Radio 3 | Radio 4 | Radio 5 |
| Expected                          | 140.634 | 217.328 | 124.523 | 188.330 |
| High                              | 210.953 | 325.992 | 186.785 | 282.496 |
| Low                               | 91.413  | 141.263 | 80.941  | 122.414 |

<sup>a</sup> These represent the average annual cost per student of adding a fairly large group of students to the system in a location where there is no transmitter available. For either small or large groups of students, adding to the system in a location with a transmitter would cost about Rp. 54 less than indicated in the table--see column 4 of Table 3.

TABLE 7

| Implementation of Radio 5 <sup>a,b</sup> |                         |                      |                                     |                        |                               |                        |
|------------------------------------------|-------------------------|----------------------|-------------------------------------|------------------------|-------------------------------|------------------------|
| Cost Per Year for                        |                         |                      | Cost Element                        |                        |                               |                        |
| Year                                     | Programing <sup>c</sup> | Transmitter Purchase | Transmitter Operations <sup>d</sup> | Receivers <sup>e</sup> | Printed Material <sup>e</sup> | Teacher Workshop TOTAL |
| 1                                        | 225                     | 0                    | 0                                   | 0                      | 0                             | 225                    |
| 2                                        | 225                     | 0                    | 0                                   | 0                      | 0                             | 225                    |
| 3                                        | 225                     | 525                  | 53                                  | 380                    | 750                           | 2218                   |
| 4                                        | 225                     | 525                  | 105                                 | 380                    | 750                           | 2270                   |
| 5                                        | 0                       | 525                  | 158                                 | 380                    | 750                           | 2098                   |
| 6                                        | 0                       | 525                  | 210                                 | 380                    | 750                           | 2150                   |
| 7                                        | 0                       | 525                  | 263                                 | 380                    | 750                           | 2203                   |
| 8                                        | 0                       | 525                  | 315                                 | 760                    | 1500                          | 3275                   |
| 9                                        | 0                       | 525                  | 368                                 | 760                    | 1500                          | 3328                   |
| 10                                       | 0                       | 525                  | 420                                 | 760                    | 1500                          | 3380                   |
| 11                                       | 0                       | 525                  | 463                                 | 760                    | 1500                          | 3425                   |
| 12                                       | 0                       | 525                  | 525                                 | 760                    | 1500                          | 3485                   |

<sup>a</sup> Costs are expressed in thousands of US\$.

<sup>b</sup> The pattern of implementation whose costs are shown in the table assumes an initial two-year period of programming and curriculum development at the end of which time a decision would be made concerning implementation. The implementation rate shown is for one million new students to be receiving radio each year from year three on, for ten years. Thus, there would be four million students using the system. Numbers in the table are based on equation 4.4 and the cost figures shown preceding the equation 4.1.

TABLE 7 cont.

<sup>c</sup> The programming and curriculum development costs are based on Radio 5's requirement of 12 year-long courses at \$75,000 per course, with development spread over four years.

<sup>d</sup> Transmitter operations and maintenance were assumed to cost annually 10% of the assumed purchase price of the transmitter. The total amount spent for this steadily increases through year 12 as more transmitters are installed. Again, it should be stressed that both the transmitter purchase and operations costs in this table are almost surely overestimates; a detailed transmission would improve on the pattern of transmitter use implied in this report.

<sup>e</sup> Annual expenditures on receivers and printed material double in year 8 since, due to the assumed five-year lifetime of these item, those installed in year three must be replaced in addition to the new installations.



decision to implement follows evaluation of the success of two years of program and curriculum development. The rate of implementation is assumed to be one million students per year for ten years; more rapid implementation would, of course, increase costs in early years; but decrease them later. Similar time streams of costs can easily be constructed for the other radio alternatives, or for other assumptions about rate of implementation.

#### 4.4 Conclusion

This section has examined in more detail some of the potentially attractive alternatives for elementary education. We first reviewed a large number of instances where radio had been successfully used for education in both developed and developing countries. Some experiments indicating that radio teaches about as well as television were then discussed. Class size is a critically important variable amount conventional alternatives because of its strong influence on cost. The literature on the educational impact of class size was therefore examined. Decreasing class size seems, on the basis of this literature, to have much less effect on student performance than is commonly supposed. It is altogether possible that variation of student-to-teacher ratio over the range 20 to 60 would have very little effect, if properly planned for in advance.

Next, the cost of radio was divided into programming, transmitter, receiver, teacher training, and student book components. Four ways of using radio to supplement the teacher substantially (in either one or two courses for about one half-hour per course per day) were described and total, average and marginal cost expressions were derived for each of these. The cost of providing a half-hour of instruction per day in each of two courses is less than Rp. 300 per student per year, all costs considered, if only 10% of elementary students are using radio. The cost would be less if more students were involved. This amount of radio could be provided at no increase in perstudent annual costs if the student-to-teacher ratio were raised from 35 to 40.

### 5. COMPARISON OF ALTERNATIVES

In this section we use information from Sections 3 and 4 concerning cost and performance to compare several of the more attractive alternatives. The comparison is made for equal costs -- f, the rate of growth of effective expenditures, is assumed to grow at 3% per annum -- to see which alternatives perform best in terms of graduates and participation rates. The alternatives compared are radio versus conventional means for changing teacher quality, decreases and increases in student to teacher ratio, and Radio 2 through 5. With the information now available, these comparisons can be made rather quickly.

### 5.1 Changes in Teacher Quality

The basic alternatives considered here are those described by Miarso (1971) who provides a preliminary cost comparison of changing teacher quality by radio (Radio 1) with changing it by conventional means. The latter is found to be much more expensive -- Rp. 13,366 as opposed to Rp. 4,656 per teacher -- and the question to be examined here concerns the impact of this cost difference on numbers of graduates. This involves several steps.

First, these costs are annualized by a factor of  $a(.15,10)$ , and added to teacher salaries. This higher cost per teacher allows fewer students to be enrolled with a fixed budget; this effect is counterbalanced by improving the efficiency of the system. The amount by which efficiency is improved depends on the amount of change in dropout and repetition rates and the growth rate of effective expenditures of 3% per year, an apparent efficiency is computed. Total budget, cost per student (including the additional cost for the teacher training) and apparent efficiency give the number of graduates. This is shown as a function of time in Table 8 for Radio 1 and conventional teacher instruction. These figures are shown for several values of percentage change in the dropout rate; the percentage change in repetition is assumed to be twice that, since repetition rates are much less influenced by economic factors than are dropout rates.

As there are no hard data to support an estimate of how much this change in teacher quality would affect dropout and repetition, it remains a matter of judgment. The value of Table 8 is that it shows the implications of alternative judgments. The cost of this quality change is sufficiently low -- it increases annual per student costs from Rp. 2,070 to 2,096 in the case of Radio 1 and to 2,146 for conventional retraining -- that with the best estimate 4% change in dropout rate, either alternative does better than the conventional one. However, the amount of improvement is rather small -- 1.65 million graduates for Radio 1 in 1982 versus 1.59 million for the present system, with a 3% growth rate of effective expenditures.

### 5.2 Effect of Changing the Student-to-Teacher Ratio

This subsection examines the implications of changing the average student-to-teacher ratios, from 35 down to 28 and up to 48. From the discussion in Section 4.2, one would conclude that variations over this range should have relatively little impact. Nonetheless, a range of possibilities is considered from its having no impact at all on dropout to its decreasing it 12% when S becomes 28 and increasing 12% when S becomes 48. This change reflects an efficiency change that works in the opposite direction from the change in numbers in school resulting from changing per-student costs. The net effect of these influences on numbers of graduates has been computed and makes some difference.

TABLE 8

Effect of Change in Teacher Quality, Radio 1 and Conventional<sup>a</sup>

| Year | % Decrease from Dropout Rate of .098 <sup>b</sup> |       |       |              |       |       |
|------|---------------------------------------------------|-------|-------|--------------|-------|-------|
|      | Radio 1                                           |       |       | Conventional |       |       |
|      | 8%                                                | 4%    | 2%    | 8%           | 4%    | 2%    |
| 1971 | 1.159                                             | 1.143 | 1.134 | 1.132        | 1.116 | 1.108 |
| 1972 | 1.219                                             | 1.195 | 1.181 | 1.190        | 1.166 | 1.154 |
| 1973 | 1.281                                             | 1.248 | 1.229 | 1.251        | 1.219 | 1.201 |
| 1974 | 1.346                                             | 1.304 | 1.280 | 1.315        | 1.311 | 1.287 |
| 1975 | 1.387                                             | 1.343 | 1.318 | 1.354        | 1.311 | 1.326 |
| 1976 | 1.428                                             | 1.383 | 1.358 | 1.395        | 1.351 | 1.326 |
| 1977 | 1.471                                             | 1.425 | 1.398 | 1.437        | 1.391 | 1.366 |
| 1978 | 1.515                                             | 1.467 | 1.440 | 1.480        | 1.433 | 1.407 |
| 1979 | 1.560                                             | 1.511 | 1.483 | 1.524        | 1.476 | 1.450 |
| 1980 | 1.607                                             | 1.557 | 1.528 | 1.570        | 1.520 | 1.493 |
| 1981 | 1.655                                             | 1.603 | 1.574 | 1.617        | 1.566 | 1.537 |
| 1982 | 1.705                                             | 1.652 | 1.621 | 1.667        | 1.613 | 1.583 |

<sup>a</sup>Table shows graduates in millions, and reflects a 6 year implementation time. Effective expenditures are assumed to be growing at 3%.

<sup>b</sup>The columns are for different percentage decreases in the dropout rate. In all cases the percentage decrease in repetition rate is twice the percentage decrease in dropout rate. The middle column is considered the most likely effect.

The case for reducing S is stronger, the greater the effect that changing S has. Our computations indicate that even with a change in dropout rate of 12%, reducing the student to teacher ratio to 28 would result in over a 10% decrease in the number of graduates per year. We conclude that the increased unit costs of Rp. 2,594 per student (and hence reduced number of students with access to education) far more than counterbalance potential gains in efficiency. Decreasing the student-to-teacher ratio would decrease the efficiency with which money is spent on elementary education in Indonesia. As one might expect, then, the reduction of per student costs to Rp. 1,741 as a result of increasing S to 48 should increase numbers of graduates. This is particularly true if the changes in S result in little or no change in dropout and repetition rates. Considerable improvement in output appears possible by increasing S.

### 5.3 Effect of Introducing Radio

The methodology of this subsection is similar to that of the two preceding subsections. Costs are obtained from Tables 4 and 5 for the various radio alternatives. In the case of Radio 2 and Radio 3, the marginal costs are simply added to the present per-student cost of Rp. 2,070 to form a total that is divided into the effective budget (again assumed to grow at 3% per year), less the fixed cost in the first column of Table 4 graduation rates are computed from the apparent efficiency of a system growing at 3% with dropout and repetition rates determined by the type of radio.

In the case of Radio 4 and Radio 5, the cost of providing radio must be added to a lower base cost of classroom instruction due to the shortened school day and increased classroom usage. The average value of S is assumed to rise to 42.5 with either of these, and classroom usage is assumed to rise to 2 classes per classroom. Again, fixed costs are subtracted from the available budget before it is divided by the cost per student.

For technology, some data are available concerning effects of its use on dropout and repetition rates. The data comes from the television reform project in El Salvador and are discussed in McAnany, Mayo and Hornik (1970). Their data support the assumption made previously that improved quality schooling has greater impact on the repetition rate than on the dropout rate, and we will therefore assume that the percentage change in repetition rate is twice that in dropout rate. Because four subjects were taught in El Salvador, and because instruction was by television, for Radio 2 the percentage changes are assumed to be one-third the percentage changes in El Salvador. (In El Salvador the dropout rate went from .133 in traditional classes to .088 in television classes.) The percentage change for Radio 3 was assumed to be 1.5 times as large since two classes were taught. In Radio 4 and 5, about 4% of the dropout rate was added to the Radio 2 and Radio 3 values, respectively, to account for a possible (though unlikely) loss in performance due to the shorter school days.



The results of this analysis appear in Tables 9 and 10, showing numbers of graduates and real participation rates as a function of time. Radio 5 is the most attractive of the alternatives, though only slightly more so than Radio 4. All the radio alternatives perform better in terms of graduates and real participation rates than does the present system. Radio 5 does about 25% better in terms of graduates and 20% better in terms of participation rate. These differences are sufficiently large, and they were computed under sufficiently conservative assumptions, to justify the conclusion that Radio 5 would very likely be superior to continuation with the present system.

The only non-radio alternative that would appear to compete seriously with Radio 5 is a simple increase in student-to-teacher ratios. This might be administratively simpler, and could result in only about 5% fewer graduates than Radio 5. In comparing these possibilities, which are fairly close quantitatively, the quality issue is perhaps central. The quality of graduates from a system that only changed by increasing S would at best only equal the quality of present graduates. There is considerable evidence that radio could do much better than this and, for this reason, as well as its slight quantitative edge, Radio 5 appears preferable. (This quantitative edge could disappear if it were possible to make S very high without increasing dropout and repetition too much.)

One further comparison of Radio 5 with the present system might be desirable, and that is in terms of cost per graduate. One can compute the ratio of cost per graduate using Radio 5 to the cost per graduate using the present system directly comparing the Radio 5 column of Table 9 to the 3% column of Table 1. The cost per graduate is 25% greater using the present system.

#### 5.4 Conclusion

Using radio for teacher upgrading is preferable to using conventional means, and would probably result in a slight improvement in the elementary system's output within the same cost constraint. Reducing student-to-teacher ratios would almost certainly reduce output of the system for a fixed budget and increasing it would increase output up to a point. Using part of the savings generated by increased student-to-teacher ratios to provide radio as an important classroom supplement for the teacher in one or two curriculums is the most attractive of the alternatives considered. One scheme for doing this, Radio 5, has a quantitative edge on simply increasing student-to-teacher ratios and an important quality advantage. It would reduce costs per graduate by an estimated 25%. In light of the discussion of Section 3 concerning the attractiveness of non-radio alternatives to the present system, the case for use of radio in Indonesia's primary schools appears to be quite strong. Before commitment to operational use of radio, however, tests of its effectiveness within Indonesia should be carried out.



TABLE 9

Effect of Radio: Numbers of Graduates<sup>a</sup>

| Year | Radio 2 | Radio 3 | Radio 4 | Radio 5 |
|------|---------|---------|---------|---------|
| 1971 | 1.108   | 1.096   | 1.342   | 1.327   |
| 1972 | 1.170   | 1.171   | 1.409   | 1.410   |
| 1973 | 1.235   | 1.249   | 1.478   | 1.495   |
| 1974 | 1.303   | 1.331   | 1.551   | 1.585   |
| 1975 | 1.343   | 1.371   | 1.597   | 1.632   |
| 1976 | 1.383   | 1.412   | 1.645   | 1.681   |
| 1977 | 1.425   | 1.454   | 1.695   | 1.732   |
| 1978 | 1.468   | 1.498   | 1.746   | 1.784   |
| 1979 | 1.512   | 1.543   | 1.798   | 1.837   |
| 1980 | 1.557   | 1.589   | 1.852   | 1.893   |
| 1981 | 1.604   | 1.637   | 1.908   | 1.950   |
| 1982 | 1.652   | 1.686   | 1.965   | 2.008   |

<sup>a</sup>Table shows graduates in millions, and reflects a 6-year implementation time. Effective expenditures are assumed to be growing at 3%.

TABLE 10

Effect of Radio: Real Participation Rate<sup>a</sup>

| Year | Radio 2 | Radio 3 | Radio 4 | Radio 5 |
|------|---------|---------|---------|---------|
| 1971 | .594    | .579    | .725    | .707    |
| 1972 | .600    | .589    | .731    | .716    |
| 1973 | .607    | .598    | .737    | .726    |
| 1974 | .613    | .607    | .743    | .735    |
| 1975 | .613    | .607    | .743    | .735    |
| 1976 | .614    | .607    | .743    | .735    |
| 1977 | .614    | .608    | .743    | .736    |
| 1978 | .614    | .608    | .743    | .736    |
| 1979 | .614    | .608    | .743    | .736    |
| 1980 | .614    | .608    | .744    | .736    |
| 1981 | .614    | .608    | .744    | .736    |
| 1982 | .614    | .608    | .744    | .736    |

<sup>a</sup>This table shows the real participation rate as defined in Section 2. It reflects a 6-year implementation time and a growth rate of real expenditures of 3%.

REFERENCE NOTE

1. All references to rupiahs in this chapter refer to 1970 rupiahs; there are approximately 340 rupiahs per dollar. Class size and classroom use estimates are based on P. Slors, "Some Bottlenecks in Indonesia's Educational System, with a View on its Future," Unpublished BPP Report, January, 1971. Daroesman uses higher estimates -- 40 to 1 for the student to teacher ratio (Part I, p. 84) and more intensive shifting to obtain high classroom utilization (Part I, p. 91).

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## CHAPTER V

### IN-SERVICE TRAINING OF TEACHERS THROUGH RADIO AND CORRESPONDENCE IN KENYA

Peter E. Kinyanjui

The situation facing educational planners in Kenya during the early years of independence was not unique to Kenya but follows a pattern to be found in many developing countries. This pattern includes a high percentage of illiteracy among the adult and working population; an increase in school enrollment as a result of growing public demand for education; increasing numbers of school leavers who cannot be absorbed into the monetary economy; an urgent need to revise and modernize the curricula in schools and colleges; shortage of money; and shortage of qualified and experienced teachers, teacher trainers, and administrators.

In order to provide education to more children, the Ministry of Education had to employ considerable numbers of under-qualified or even unqualified teachers in the schools during the early years of independence when education expansion took place in all directions. It also increased enrollments in the primary teacher-training colleges to the extent that total enrollment in colleges rose from 4,579 in 1963 to 6,732 in 1970. At the same time the colleges themselves were reduced in number from 32 to 24 in an attempt to consolidate the facilities and the resources that were then available.

In spite of these developments in teacher education, the total output of these colleges could not match the rising demand for qualified teachers or even replace the existing unqualified staff in the schools. Hence the Ministry of Education mounted in-service teacher training and upgrading programs as the only way of providing more qualified teachers. The programs were quickly accepted by teachers because they permitted them to obtain academic and professional qualifications while employed.

Correspondence education, another possible source of training, was not highly regarded in Kenya at that time mainly because of the unsatisfactory record of the numerous commercial correspondence colleges that were operating throughout the East African region. These colleges were based in Britain and America, the courses they offered were irrelevant and out-of-date, and the fees charged were usually very high. The drop-out rate of students enrolled was reckoned to be about 70 percent. Students enrolled with these commercial colleges since, as most of them admitted, there were no other possibilities for self-improvement for those who did not gain admission to formal institutions, and who lived too far away from the main towns to attend evening classes.

It was against this background and the urge to increase the speed of Kenya's educational development that the Kenya Education Commission was set up under the chairmanship of Professor Simeon Ominde to look into the whole educational system and to make recommendations to the Minister for Education. The report of this Commission which was published in two parts in 1964 and 1965 has largely influenced and guided national policy towards education in Kenya since independence. Out of their Report came the decision to use radio and correspondence methods for teacher training, which is the subject of this case study.

# 1. ESTABLISHING A CORRESPONDENCE COURSE UNIT

The idea of the Ministry of Education establishing radio/correspondence education in Kenya was first proposed in 1964. At that time the Kenya Education Commission urged consideration of a "combination of lessons by radio with an approved correspondence course." Furthermore, the Commission suggested that if the required facilities could not be provided by already established commercial correspondence colleges, "it may ... be necessary for the Ministry itself to enter the field of education by correspondence ..." (Kenya Education, 1964).

Two years after publication of the Commission's report, the Government of Kenya sought technical assistance from the United States Agency for International Development (USAID) for the establishment of the Correspondence Course Unit (CCU) in the Institute of Adult Studies, University College Nairobi (now the University of Nairobi).

Top priority was given to courses preparing adults, and particularly to the upgrading of primary school teachers. According to the Annual Report of the Ministry of Education, there were 37,923 teachers employed in Kenya primary schools in 1968. Of these, 10,438 were not professionally qualified. Out of the 27,285 qualified teachers, there were 16,992 P3 teachers who were the mainstay of the primary schools, comprising about 61 percent of the qualified teaching staff and almost 45 percent of the total teaching staff (Ministry of Education, 1968).

Normally, a P3 teacher will have had seven (in some cases eight) years of primary education plus two years of teacher training. For such a teacher to become eligible for promotion to the next higher grade of P2, he is required to pass a national examination, the Kenya Junior Secondary Examination (KJSE) which is formally taken after two years of secondary education. Prior to 1968, a candidate was required to pass at least five subjects at a single sitting (i.e., in the same year) in order to earn a KC certificate. At the recommendation of the CCU staff, this requirement was changed for all P3 teachers so that they were allowed to sit the examination in as few as two subjects a year and to carry forward credit for individual subject passes from one year to

the next until they had accumulated passes in five subjects. Thus, the first correspondence courses produced by the CCU in 1968 were aimed at preparing these teachers, and other adults who had completed primary education, for the KJSE.

In 1969, the CCU undertook a second program to run concurrently with the KJSE Preparatory Courses. At the request of the Ministry of Education, the CCU agreed to cooperate with the Kenya Institute of Education (KIE) in its in-service training course for unqualified teachers (UQT). The UQT upgrading course is intended to improve the teaching effectiveness of previously untrained teachers. The program is conducted in two phases. The first is professional training in methods of teaching organized by the KIE and consisting of a year's study divided into three short residential courses during school holidays. Between the residential sessions, the courses are supplemented by radio lectures. Candidates who successfully complete the first phase of the program are then admitted to the second year's academic course conducted by the CCU. The unqualified teachers, however, study only three subjects (English, mathematics and either history or geography) at the first-year secondary level. Those who successfully complete the correspondence course and pass the final examination are upgraded to P3 status. The UQT program is evaluated later in this chapter.

A survey conducted in 1968 - (Kinyanjui, 1968) revealed that a large proportion (90 percent) of the CCU students are teachers. The remaining 10 percent include clerks, farmers, housewives, members of the Armed Forces, Police and Cooperative staff. A typical student is between 21 and 40 years old, married, and has more than four dependents, including members of his extended family. His house has no electricity, and he owns very few books. He may have access to a very small library, but it is probably miles away and impossible for him to use regularly. He does not regularly buy a newspaper, but he does own a radio which is his principal source of news and information about the world outside his own small community. It is mainly for this reason that radio programs prepared by the CCU and broadcast over Voice of Kenya are used to supplement the correspondence instruction.

### 1.1 Operation

To date, the CCU has offered the following subjects at both Form One and Form Two levels: English, Kiswahili, history, geography, mathematics ("modern"), biology and physical science. Those courses are not merely "cram" courses for the KJSE, but are designed to cover the academic work normally done in two full years of study in secondary school. Moreover the modus operandi of the CCU involves planned and systematic selection, preparation and presentation of teaching materials, as well as securing and assessing what the student has learnt. Hence, the instructional program provided by the CCU comprises a synthesis of the following:



1. Correspondence study guides, textbooks and other teaching materials such as maps, mathematical instrument sets, science experiment kits, etc.;
2. Supplementary radio broadcasts covering the material in one or more lessons of the study guide;
3. Marking of students' lessons by qualified secondary and university teachers; and
4. Occasional face-to-face teaching during residential sessions.

The instructional process is made to function by an efficient machinery for establishing and maintaining contact among the student, the teacher, and the CCU through the system for recruitment, enrollment, distribution of study materials and the handling of lessons and end-of-course examinations.

The CCU is equipped with its own printing, duplicating and binding facilities, registration, mailing, records and accounts sections, a self-contained recording and production studio for radio, and a small science laboratory. The Adult Studies Centre adjacent to the CCU provides all facilities for residential courses for up to 60 students. The CCU staffing complement comprises eleven members of the academic staff, all appointed under the University's terms of service. It is gratifying to note that all staff is Kenyan. The academic staff consists of the Head of the Unit who is also an Assistant Director of the Institute of Adult Studies, seven correspondence tutors, a course development tutor, a radio/TV specialist and a course editor. In addition, the CCU draws upon the services of about 50 practicing teachers in and around Nairobi as part-time course markers.

All lessons in the study guide contain selective (rather than exhaustive) self-test exercises with which the student checks his understanding of the study material. Alternate lessons also require written assignments to be submitted to the CCU for marking. Enrollment is open throughout the year, and a student can work as fast as he is able to, depending on the amount of time he can devote to his studies and on his knowledge of the subject. Some students have been able to cover the two-year KJSE program in one year. Others have taken longer than two years. The CCU has realized that apart from the enrolled students there are other people using its study materials in less formal ways. It is difficult to estimate the number of teachers and other adults not registered with the CCU using the study guides and textbooks for their private study. Nevertheless, it seems reasonable to assume that this "overflow" is quite substantial and that it has some broad social benefit.

## 1.2 Use of Radio

Radio offers one of the most practical and effective means of communication in a developing country such as Kenya. Reception in most parts of the country is generally good, and about 90 percent of the population can be reached through the use of radio. The battery-powered transistor radio, now being assembled in Kenya, has increasingly become popular with most families including those who live in rural areas. Indeed the CCU realized the great potential of radio at the early stages when it was publicizing its first courses. It was found that about 75 percent of the first respondents had heard about the courses on the radio. Other publicity media that were used with much less effect were television, newspapers, and posters. The reasons for the superiority of radio over other media were not hard to find. The immediacy of radio and the credibility of the information and messages carried by radio constitute some of the strengths of this medium. To most people living in the rural parts of Kenya, radio offers the only source of news and information about what is happening outside the small communities and villages. It was because of these and other factors that the CCU decided to develop radio broadcasts as an integral part of the instructional system.

The correspondence course material in one or more lessons is supplemented by a 15-minute radio program that is broadcast twice a week over the Voice of Kenya. The CCU radio programs are allocated a fixed air time from 5 to 6 p.m. every weekday throughout the year. The Voice of Kenya plans its yearly programs in quarters, and so the CCU radio lessons are planned accordingly. At every quarter the previous radio programs are repeated for the benefit of any students who might have fallen behind schedule and for those students who will have enrolled in between the quarters.

The radio lessons are not mandatory, and there are many students who work ahead of the radio programs although some do make a habit of listening to the programs at later stages. The radio lessons are particularly aimed at the slower students and are used to pace and encourage them. The radio teacher tries to highlight the important points in a lesson and to provide a summary at the end of each teaching unit. Occasionally the radio teacher will arrange for a question-and-answer type of program whereby the problems common to many students are dealt with and common mistakes are corrected.

Although the written materials that the student receives from the CCU are self-contained to give all instruction necessary, radio broadcasts have been used regularly to supplement instruction in each subject in the same way that a classroom teacher would offer extra help to the slower students to encourage them, sustain their interest, answer their questions, and help them solve their problems. The radio programs have proved to be particularly useful for speech-work in the two language courses as well as in maintaining good rapport between the student

and the teacher. It has been established that a large proportion of the enrolled students make a point of listening to the radio programs regularly or occasionally, although many of them may be working through their lessons well ahead of or behind the radio schedules.

The CCU radio tutor is involved right from the start in the planning and development of every course that has a radio component. He works closely with the course writers in order to translate educational ideas and concepts into media practice. Through such a close working relationship it has been possible to produce a fuller integration of the broadcast media with the other components of courses that are offered by the CCU.

A comprehensive evaluation of the CCU program was carried out in 1972 and it dealt, in part, with the students' own assessment of the value of the radio lessons in their studies.

The radio broadcasts have attracted very many casual listeners besides the students enrolled with the CCU. A survey conducted in 1969 (and revised in 1975) by the Voice of Kenya (Ministry of Information, 1969, 1975) revealed that there are a minimum of 318,000 and a maximum of 817,000 adult listeners who have their radios on when the CCU broadcasts are "on the air" (i.e. between 5 and 6 o'clock in the evening). Consequently, the CCU has been modifying the radio programs into a more flexible format to cater to those listeners who are not studying for examinations but simply find the programs interesting and informative. This audience can only be termed "accidental" because when the programs were launched it was thought that they would be useful only to those who were enrolled and received written materials regularly. The notion was proved wrong in the first year of operation. As a result, the CCU had to modify the radio programs gradually so as to cater, not to a specialized group of listeners, but to a general audience with wide interests. Furthermore, the Institute of Adult Studies has plans to utilize this large "captive" audience for the proposed rural education programs using mass media. As a start, several institutions in Kenya have agreed to cooperate in a pilot project that will experiment with integrated use of three media, namely, film, radio, and newspaper. These will be used in conjunction with organized discussion groups in various rural areas, and if successful, they will be developed and multiplied on a national scale. This will be another by-product of the CCU project.

A small but special group of CCU students comprises blind students who have relied mainly on listening to radio programs and having the written materials read to them by relatives and friends. This problem has now been overcome since the Hadley School for the Blind in Winnetka, Illinois in the United States has translated the courses into braille for the sake of blind students. The CCU provides copies of the radio programs on cassettes to these blind students and any other students who request them.

The experiences of the CCU have shown that, compared to television, radio is relatively inexpensive and is able to reach a very large audience including people who live in remote rural parts of the country. Radio has a low unit cost for the production and the transmission of the programs, and the level of professional training demanded by radio in the production of programs and maintenance of equipment is an additional advantage. Experience has also shown that in a verbal society such as Africa's where oral traditions are still strong, radio can be a powerful medium of information and instruction and can help to create a feeling of participation and personal involvement on the part of the listener. It should therefore be used more intensively.

## 2. EVALUATION OF THE KJSE PROGRAM

At the fifth year of its operation, the CCU was anxious to evaluate its work. The evaluation, carried out in 1972 by someone from outside Kenya, was based on responses made by the students enrolled in the KJSE program. The final report (Treydte, 1972) of the evaluation produced some interesting assessments of the Unit from the students' viewpoint, as well as many useful comments, criticisms, and suggestions made by the students.

A part of the questionnaire dealt with some of the major difficulties the student found himself confronted with during his study process. Roughly 60 percent of the student's obstacles to study were found to be environmental difficulties, particularly lack of sufficient time to study, personal and family problems, and unfavorable conditions for study. The actual pedagogic difficulties that faced the student were found to constitute only about 10 percent of the total.

### 2.1 Drop-out rate

From the responses to another part of the questionnaire, we can derive some information about the drop-out rate of the CCU students, although we can argue only indirectly. It was not possible to ask the question directly: Do you think you are a drop-out? This would have been a pejorative question. But taking into account that about 56 percent of CCU students had registered for the KJSE, one could say that such students could not be considered as drop-outs. Others indicated that they were not prepared to sit for the examination while a few referred to personal and "other" difficulties. The CCU enrollment also includes a good number of students who do not study in order to sit for the KJSE, while another group consists of those who, having passed the examination, feel they still need to complete the course in which they initially enrolled and for which they had paid.

Another factor that makes it difficult to quantify the drop-out rate of the CCU students is that there is no time limit put on a



student once enrolled. He is at liberty to study at his own pace depending on his personal circumstances and his previous knowledge of the subject. The radio programs that supplement the printed materials are repeated every four months during the year and the student can therefore benefit from the radio. Nevertheless, the Research Fellow estimated the drop-out rate of the CCU students as somewhere between 15 percent and 25 percent. This is extraordinarily low as compared with other correspondence instruction research findings. Glatter and Wedell (1971), for example, quoted a well-established German correspondence institution which indicated that only 28 percent of their students completed their course.

There is no doubt that the majority of the CCU students, mainly teachers, are very highly motivated by the immediate benefits in terms of promotion and the increased salaries they receive on their passing the examination. Many of them have also become aware of the urgent need to upgrade themselves in their professions as the lower grades are gradually being phased out and as the jobs are getting more competitive. It is little wonder then that the retention rates are so high.

## 2.2 Examination Results

Since 1968, the CCU has carried out various analyses (Ntaxibi, 1968-70) of the student's performance in the KJSE. The results reveal that the candidates who have studied with the CCU have performed better than other candidates sitting the same examination. The average pass rates for CCU candidates were 42 percent in 1968, 46 percent in 1969, and 51 percent in 1970, as compared with school candidates who achieved 8 percent to 15 percent pass rates. In 1970 when the government-aided schools averaged 47 percent, the unaided schools 20 percent, and the private candidates 13 percent, the CCU candidates achieved 51 percent pass rates. In the various subjects offered by the CCU, the average pass rates have gone as high as 76 percent in Kiswahili, 57 percent in English, and 55 percent in history. In looking at these figures, it is perhaps unfair to compare the performance of private candidates with that of teachers because while the former must pass in at least five subjects at one sitting, the latter are allowed to take parts of the examination until they accumulate passes in five subjects. It is hoped that the Ministry of Education will remove this discrepancy and accord the same concessions to all the candidates.

In analyzing the reasons for their failure in the examination, the CCU students tended to be too self-critical in their replies. Roughly 50 percent said that they did not work hard enough in their study materials, 17 percent indicated that they did not submit enough written assignments, and 11 percent quoted lack of sufficient radio listening. The general tendency with all teachers was to register for the examination almost every year and in more subjects than they could



objectively pass, with the hope that they might collect the required number of passes in the shortest time possible. This does therefore cause some statistical inaccuracies in the official reports.

### 2.3 Discussion of Examination Results in the CCU

Encouraging as the above results for the CCU candidates are, it is too early to conclude that they indicate success. It has yet to be demonstrated that a P3 teacher, for example, improved his performance in the classroom after being upgraded to the P2 grade. Nevertheless, for most CCU students, this was the first time they had ever been engaged in an organized and systematic form of study since they left formal institutions. This has been confirmed by many letters from successful students who felt that they benefitted from the correspondence courses, and that they received individual and personal tutoring through the mail and through the radio from teachers they probably had never met.

The CCU's approach to instruction has largely been directed toward non-examination ends. Apart from other hidden and intangible benefits that a teacher gets on upgrading, the examination-oriented curriculum has been accepted, for the present, as the means by which a teacher could improve his status in the profession and earn a higher salary. It is also true that the KJSE preparatory course helps a teacher to move a bit higher on the conventional academic ladder, and, with enough self-discipline and dedication, he may in time go on to gain his secondary school certificate. It therefore seems likely that a teacher who has completed the two years of secondary school education will be a better teacher than one who has not, all other things being equal. But the KJSE preparatory course per se may not be the most suitable curriculum for improving a teacher's professional skill. Hence it seems proper that a separate program based on syllabuses suitable for adults in the teaching profession should be introduced.

The results outlined above have been achieved partly because of the maturity and motivation found in adult students, but also partly because of the immediate returns the students get from their studies through promotion in the job, raise in pay or improvement in their job performance. Practicing teachers particularly have found immediate application of knowledge gained in their teaching. The changing curricula in Kenya's schools make it necessary for a teacher to update his knowledge and understanding of the new courses he is required to teach. A good example of this is the gradual introduction of "modern mathematics" in primary schools; this means that a teacher who is enrolled in the mathematics course finds that what he learns is put into immediate use in his teaching of modern mathematics. This is one kind of motivation that the CCU successfully tried to foster in adult teaching: what is taught should be learned in a situation much like that in which it is to be applied. The correspondence tutors have therefore used their discretion in developing their own courses to suit a wide range of

adult students including those who do not enroll just to pass the examinations--provided, of course, that the complete courses meet the requirements for national examination syllabuses.

Thus the CCU has tried to dispel the old belief that ability to learn decreases with age. It has been demonstrated through these preliminary results that adults can learn as well as young people, and that the correspondence method of instruction can be as effective as conventional face-to-face teaching. One could only conclude that the apparent decline in anyone's ability to learn is largely the result of lack of motivation. There is no doubt that most of the CCU students have been highly motivated by the various factors explained earlier.

### 3. EVALUATION OF THE UNQUALIFIED TEACHERS' PROGRAM

As described earlier the Unqualified Teachers' Program (UQT) was mounted in 1969 jointly by the Kenya Institute of Education (KIE), which is the body responsible for teacher education, and the Correspondence Course Unit (CCU) of the University of Nairobi. During the 1969-72 period, over 10,000 unqualified teachers successfully completed the upgrading courses through radio, correspondence, and residential study and have been awarded the Primary Teacher's Certificate. In order to assess the performance of these teachers in their jobs, it was felt necessary to conduct a follow-up study on a sample of these teachers.

The study was done through questionnaires and face-to-face interviews at two different levels. At the first level, the study was concentrated on the teachers themselves about their own assessment of the program and its effects on their profession. At the second level, the opinion of the educational authorities was sought regarding these teachers in particular, and the upgrading program in general.

The UQT in-service training program is the only means by which unqualified teachers can be upgraded to the P3 status, and, after serving further in the profession, they may attempt higher examinations to attain even higher status. The candidates are carefully selected from among those who have been teaching for over three years and have given evidence of ability and motivation. The program is controlled by the KIE through their field officers, and the course proceeds in chronological states. The residential sessions held during school vacations are compulsory, and the final examination is conducted at the end of the year. It is, thus, a rigidly controlled, single-purpose and "closed" in-service program, and it has ipso facto proved to be highly successful in terms of completion rates of the assignments and pass rates in the final examinations.

### 3.1 Examination results

Since 1969, the UQT program has produced very encouraging results. About 82 percent of those enrolled in the program have completed their courses successfully and have been awarded P3 teachers' certificates. The average percentage of passes in the final examination in academic subjects is English 95 percent, geography 96 percent, mathematics 90 percent, and history 86 percent. But one must look beyond these figures of student enrollment and examination results. The more important factor is whether the teachers upgraded by this method improve their performance in their jobs. It is worth noting that, according to the assessment of the Kenya Institute of Education, the unqualified teachers who completed the course and were issued teaching certificates compare very well academically and professionally with those qualifying from the teachers' colleges. But this needed to be verified. A follow-up study was therefore conducted at two different levels. First, it was directed to the teachers who had been upgraded, and, second, to the educational authorities who were in contact with these teachers.

### 3.2 The teachers' point of view

At the first level, the study was concentrated on a sample of past students who had studied through CCU and had been awarded a teachers' certificate. As far as the teachers themselves were concerned, the in-service course had been useful for their professional uplift. Almost 99 percent of them felt that their performance in the classroom had improved as a result of the in-service upgrading course. Many of them indicated that they felt greater confidence in their teaching, and that they commanded greater respect from their fellow teachers than before.

A number of these teachers also indicated that the course in "modern math", which they had taken as one of the compulsory subjects, had proved to be very useful in their classroom teaching because of the recent changes in the primary schools syllabus based on the "modern math" approach. It was also evident that the upgraded teachers were more secure in their jobs and stood a better chance for further promotion after three or four years of service than the unqualified teachers. In fact the unqualified teacher in Kenya is constantly under threat of being phased out of the teaching service as more qualified teachers join the profession. This, in effect, has provided one of the strongest motivating factors for the in-service training course. The other factor is, of course, the substantial salary increase that a teacher gets after being upgraded.

More significant, perhaps, is the fact that about 48 percent of the respondents had pursued further courses of study after the initial qualification. Most of these teachers had sat for the Kenya Junior Secondary Examination in certain subjects, and about 20 percent of them had even gone on to study for the East African Certificate of

Education ("O" level). This means that, given proper directions for study, a teacher can, in time, attain the higher primary teaching grades of P2 and P1 through in-service training. Another significant point to note is that none of the past students who were interviewed had changed his career after being upgraded and they did not know of any of their colleagues who had done so.

Among the suggestions put forward by the respondents there was a request to increase the number of academic subjects offered in the upgrading program. Many teachers felt that there should be more optional subjects to choose from than just history and geography, and that the authorities should consider including other relevant subjects for classroom teaching purposes as well as for future examination purposes. The one-year professional training was considered to be inadequate by many teachers who suggested extending it into the second year of academic study. It should be possible, through the combined effort of The Kenya Institute of Education and Correspondence Course Unit, to incorporate most of these suggestions in future plans for in-service teacher-training programs.

### 3.3 The Authorities' Point of View

At the second level, the follow-up study was directed towards the educational authorities, and in particular the headmasters, education officers, and supervisors of those schools where the respondents were teaching. It was important to get a recorded opinion of these educational authorities, not only on the quality of teachers upgraded through the in-service courses, but also their reactions toward the whole idea of training teachers by unorthodox methods.

It was found from the authorities interviewed that about 95 percent of the teachers under their supervision had improved their performance in the classroom after the upgrading course. This was evident particularly in the three subjects they had studied, namely, English, mathematics, and either history or geography. More important was the observation that there had been visible improvement in the classroom performance and the examination results of the pupils who were taught by these teachers. The effectiveness of a teacher is still measured, in most cases, unfortunately, by the performance of his pupils in the national examinations. Of the cases examined, 90 percent of them reported some improvement in the pupils' performance.

The educational authorities interviewed were, on the whole, favorably impressed by the quality of the teachers upgraded through the in-service training course. They often commented on the apparent determination of these teachers to improve themselves further by attempting higher examinations. None of the teachers had changed his career. One or two headmasters reported some cases where there was not enough checking of the pupils' work because the teachers were busy at night studying for further qualifications. But, on the whole, there was



general agreement among the authorities that the more diligent teachers strived to improve themselves and were more committed to their jobs, while the lazy teachers often neglected their studies as well as their pupils. All the authorities encouraged the teachers to continue to improve themselves in their profession. A few did criticise the unqualified teachers' program, particularly on the inadequacy of the professional training. The period spent on this part of the program was considered too short and many authorities recommended its extension into the second year. The academic part of the program was better handled, but a suggestion was put forward to increase the number of subjects in order to provide more options for the teachers.

All the authorities agreed that the in-service training courses offered the best opportunity for most teachers to improve their knowledge and skills, and that the traditional teacher-training colleges were not able to cope with the increasing demands for qualified teachers in Kenya. They agreed also that in-service training courses gave the teachers a good opportunity to apply their knowledge and skills in the classrooms, and to test their suitability in the actual teaching situations. One school supervisor went further to suggest that radio and correspondence methods should be used to disseminate the latest information about curricula changes, teaching methods, and educational policies among teachers, administrators, and parents alike throughout Kenya.

### 3.4 Discussion of UQT Evaluation Results

The above follow-up study revealed many good qualities about the in-service training program which should be maintained and improved. It revealed also some weaknesses inherent in the program as seen by the teachers themselves and by the educational authorities who are in contact with the teachers. Many constructive suggestions for improvement were offered by the people interviewed. Effective action on these suggestions calls for joint effort on the part of not only KIE and CCU but also the Ministry of Education and the Teachers' Service Commission. The provisions made in 1974 for free primary education in Kenya call for more unqualified teachers to be employed. This means that in-service teacher-training programs will continue to grow. It is important that this growth in numbers should be accompanied by improvement in the quality of teachers produced. By bringing together a group of educators, practicing teachers, and schools supervisors, it is hoped that a better in-service teacher-training program will be developed.

## 4. RECENT CHANGES IN TEACHER EDUCATION PROGRAMS

On the tenth anniversary of Kenya's independence, a Presidential Decree introduced free primary education in Standards I to IV,



effective on January 1, 1974. This decision produced a dramatic increase in primary-school enrollments and a subsequent abnormal demand for additional teachers. The enormous task facing the Ministry of Education was to find teachers for the extra classrooms in the shortest time possible. As a stop-gap measure additional numbers of unqualified teachers were employed, contrary to the previous policy of the Ministry aimed at phasing out and eventually eliminating unqualified teachers from the service. At the same time, the Ministry embarked on a drastic reorganization of teacher education programs that, in certain respects, meant an expanded and a crucial role for the Correspondence Course Unit.

Briefly, the magnitude of the problem was that primary school enrollments immediately rose to 2,765,651, which was a half million more than the Development Plan figure for 1974. To deal with this problem it was estimated that a primary-teacher force of over 72,000 was required. So although considerable progress had been made since 1968 in providing a larger and better qualified core of teachers, the demand was growing faster than the provision. Whereas the total number of unqualified teachers in primary schools had been reduced to only 12,000 by the end of 1973, with the sudden jump in numbers required for 1976 it would mean at least 25,000 of the newly appointed teachers would inevitably be unqualified.

Against this background and the practical realization that enrollments at Standard I level will continue to rise at not less than 3 percent per year, the demand for more teachers will remain for many years to come.

The 1974-78 Development Plan recommended an increased output of P3 teachers through the training colleges and, more emphatically, through the in-service courses. The previous plan of scaling down the P3 teachers and developing more P2 and P1 teachers had to be reversed, although this was ideally in line with the Ministry's accepted educational policy as well as being professionally sound. It was recommended that the normal two-year teacher-training course in residential colleges should be reduced to one year in order to accelerate the production of trained teacher manpower. After the one-year course in residence, the training would be conducted through a series of radio and correspondence courses and short vacation courses, and the teachers would be certificated on a "credits" system. This in-service course would extend over a two-year period, but it would mean that the teacher was available in the classroom while, at the same time, he was undergoing training. The whole scheme has come to be known as "1 + 2 teacher-training program". Over a period of three years, this scheme would double the output in the number of trained teachers entering the profession, that is, from 4,000 to 8,000 per year.

The upgrading of the unqualified teachers would continue as before except that the annual intake would be increased in order to take

into account the extra numbers of teachers that have, of necessity, been employed without professional qualifications.

The two programs will run simultaneously, but it has been accepted that people from other institutions will have to share in the responsibility for the expanded in-service teacher-training courses. These will include primary-school inspectors, district education officers, teacher-training college tutors, and the curriculum development teams. The Kenya Institute of Education will continue to select the teachers due for training and to organize the residential sessions and to conduct the examinations and final assessments. The Correspondence Course Unit will handle all the operations of correspondence teaching, written assignments, and students' records as well as the accompanying radio programs. The CCU staff will also train correspondence course writers and markers from other institutions for any additional courses to be included in the expanded program. College tutors, for instance, will be selected to write correspondence courses after some training workshops, and they will be released from other duties in order to work in course development teams. It is hoped that such institutional cooperation will make better use of the qualified personnel available to produce better quality courses than before. It has been recognized that the present syllabus being followed in the KJSE and other teacher-upgrading programs is inadequate. Although the CCU in its teaching has tried to enlarge and liberalize what is a fact-crammed course, it is still highly unsuitable for adult teachers. By bringing together a group of educators, practicing teachers, and schools supervisors, it is hoped that a better in-service teacher-training program will be developed. The Ministry of Education indeed recognizes that, in the long run, a continuing process of teacher education will be the best way to deal with the current and future problems. It will allow for new methods and techniques, the changes in curricula, and the use of mass media to be brought to the teacher's attention.

The 1974-78 Development Plan has stressed that "correspondence courses and radio programs must remain the main vehicles of out-of-school education". It has therefore recommended an expansion of the CCU facilities at Kikuyu into a Mass Media Center. One of the strong arguments in support of this expansion is that there already exists within the CCU considerable expertise and experience to build on. The role of the mass media should not be underestimated; hence the other argument is that, properly utilized, mass media provide one of the means whereby the best teachers that are available can make the maximum impact, and it is through teacher education that the impact can produce immediate improvement in the quality of education. The Mass Media Center will be concerned with a variety of media and their possible mixes or combinations. The courses to be offered will cover different levels of formal and non-formal education. There will be more involvement of and cooperation with the Voice of Kenya and the Kenya Institute of Mass Communication. Evaluation of the work of the Mass Media Center will constitute a central and continuous activity, and this will be conducted by staff from within as well as outside the center.

## 5. SOME GENERAL CONCLUSIONS

There are a number of factors in the Kenya case study that apply more generally. This case study has demonstrated among other things the need for a definite commitment from the government in an educational venture such as the one described here. Its success has, to a large extent, been due to the close consultation and co-operation between many different bodies--the Ministry of Education, the Ministry of Information and Broadcasting, and the University of Nairobi. The fact that the CCU was set up within the University enabled it to attract and recruit staff of high caliber and also gave it access to a wide range of expertise.

The flexibility of the CCU's structure and operation have made it possible to cope with the changing educational levels' needs. The efficiency of the central service agency which handles the practical day-to-day operations in correspondence instruction has been crucial for the success of the CCU. The occasional breakdown of these operations in the past only goes to underline the importance of an efficient machinery to handle all the communication that goes on among the Unit, the student, and the tutor. Over the first few years of its existence, the CCU has developed into a viable "service unit" which can provide specialized administrative machinery for teaching at a distance, and cater to adult students at varying levels of training. The Unit is now able to widen its activities to include, at the one extreme, mass rural adult education, and, at the other, external degree courses for the University of Nairobi.

The changing use made of the radio component in the learning package also illustrates the need for a flexible approach. In 1964 the report of the Ominde Commission urged a "combination of lessons by radio with an approved correspondence course". When the CCU operation was set up, a change in emphasis had already taken place by which the correspondence course had become the core of the learning package, and the radio broadcasts were an integral but supplemental part of the student's work. By 1969 when it was found that a large eavesdropping audience was listening to the programs, the CCU took the decision to modify the radio component into a more flexible format and so to try to capture the listeners who, though not studying for examinations, obviously found the programs interesting and informative. It might be argued that in so doing the specific needs of the students were in danger of being submerged by the general needs of the community. But the subsequent development of mass rural education for the general audience should relieve any clash between the two, provided that sufficient time and resources are available.

At present the CCU has been allocated five hours per week of free air time for radio broadcasts on the Voice of Kenya. Another fifteen hours per week of the educational radio air time is used by the

Schools Broadcasting Unit and other government departments for their educational programs in the fields of health, agriculture, co-operatives, commerce, and industry. The rest of the prime time is taken up by commercial programs since Voice of Kenya has to raise about one-third of its operating costs through advertising. The argument for a separate education channel is to lessen competition over the available prime time between educational and other programs. The argument against is the possible loss of the large casual audience for educational programs if these are transmitted through a strictly educational channel. It might mean that if a separate educational channel is provided, a more exact distinction will have to be made between formal and non-formal educational programs, with provision to exchange programs on the channels occasionally.

On the question of costs, a project such as the CCU is an attractive economic proposition to a government with limited resources. Once the distance teaching unit has been set up, complete with its operations and network, it is relatively easy to change or modify course content as dictated by needs. The student numbers can also be increased quite considerably without a corresponding increase in the number of full-time staff or in the capital outlay on buildings and equipment. In the case of CCU, economies of scale have gradually been realized as the student enrollments have continued to rise with more course offerings. Over the last ten years, there has been no increase in the fees charged to the students, and the government's annual contribution to the recurrent budget of the Unit has been maintained at about the same level although the student numbers have more than doubled during that time. The recent changes in teacher-education programs in Kenya will mean even higher student enrollments and consequently much lower recurrent costs per student than at present. This points to one of the advantages of distance education, namely, that, in the long term, it is cheap and cost-effective. It can exploit economies of scale; it can make full use of existing facilities and services from other institutions; and it can make more efficient use of the time and skills of educators and teacher trainers who are in short supply. The teachers and other adults receiving their education and training through distance-learning methods can continue in their jobs and earn their livelihood and therefore, far from being a financial burden on the country, contribute to the economy.

A further advantage, related to the overall issue of costs, is the returns to the country from educational expenditures in terms not only of increased trained manpower, but also of the more ephemeral qualities of national life which result from an all-round improvement in educational standards. It is, clearly, difficult to put a value on benefits of this sort; however, it is possible to discover some of the incidental benefits that distance-teaching media can bring. Such benefits may include, for instance, the extra numbers of people who share correspondence course materials with the enrolled students, the large numbers of eavesdroppers who listen to the radio broadcasts, or



other adults who may be encouraged to take up part-time studies for their self improvement as a result of success scored by their colleagues.

The field of teacher training and upgrading has been accorded high priority in developing countries because of demands for more and better education at a low cost. For many developing countries, universal primary education is a distant goal that is considered well worth striving for. But the shortage of qualified teachers in sufficient numbers has been one of the main stumbling blocks. The use of correspondence methods is gradually becoming widely accepted as a practical solution to the problem of teacher training and upgrading. Beyond this initial step, there is need to continue to provide supporting and advisory services to teachers throughout their professional careers. In other words, a system of "continuing" teacher education is the one which is likely to produce long-term benefits in the educational development of a country. Obviously the use of traditional methods alone to meet these teachers' needs will be slow and expensive. Perhaps distance-teaching methods might be the most practical and most effective ways of disseminating the idea of "continuing" teacher education as rapidly and as widely as possible.

Distance teaching can, furthermore, be of direct practical help in enabling teachers to deal with some of the new problems confronting them which their training may not have equipped them for. The widespread introduction of schools broadcasting services is a case in point. In almost all developing countries, schools radio broadcasting is well developed and usually well supported by printed pamphlets and teachers' guides. The programs are usually prepared and broadcast through the national radio stations and the quality of these programs has improved considerably in recent years. However, the materials and the programs have not always been well utilized in the classrooms in a way that allows teachers and pupils to get the maximum benefit from them, mainly because the teachers themselves are not adequately prepared or trained to use them as part of their teaching. Many teachers see these programs as offering them convenient breaks in their teaching loads, and often no follow-up activities are planned. A considerable number of these teachers, particularly the older ones, have not had any radio lessons during their school days and so they do not fully appreciate their educational value. It would therefore seem that one way of training such teachers to make full use of schools programs would be to put them in a learning situation where they can experience the methods being used. This is an area in which distance teaching could be employed for giving in-service training to such teachers so that, once they have had the experience themselves, they would be in a better position to use similar methods in the classroom.

Distance teaching methods could also be applied to the training of personnel in other fields of development as well. Change will come about through teachers of all kinds, if the term 'teacher' is used



in the widest sense to include extension workers in agriculture, health, community development, and adult education in general. All these people who are involved in the educational process - educating the community for change - and who have many factors in common. If their training could be coordinated or at least be based upon those elements of objectives that are common, then there would be a case for attempting to develop a training course with a central core and this could provide basic training to a large number of these workers who have had little or no training. It is interesting to note that a large proportion of workers in community development and social welfare in many developing countries have worked as teachers previously, but on changing their jobs they have received very little preparation, and this only through short, intermittent seminars and conferences. Perhaps distance teaching could provide basic training to these extension workers without removing them from their jobs for long periods.

Perhaps the most effective experiment that the CCU has demonstrated is the application of different media in combination. In particular, the use of correspondence materials supplemented by radio broadcasts and occasional face-to-face instruction to reach a widely scattered adult population throughout the country has been the one distinguishing feature of the Kenyan project. The selection of teaching methods has been based mainly on what media have been available within the limited resources. The combination of different methods has helped to compensate for the deficiencies of any particular method when used by itself. The potential of distance education is gradually being realized in many developing countries such as Kenya where a large majority of the people are in great need of information, education, and training. It now remains to utilize it to its full capacity.

However, each country has its own priorities and ways of organizing its development programs. The Kenya case study that has been described above must be viewed as only one of the ways of solving particular problems at a particular time in the development of a particular country. It is also important to stress that the CCU is only one of the many government and non-government agencies that are involved in the various aspects of social and economic development of Kenya. But the need for cooperation and consultation at every stage cannot be overemphasized.

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## CHAPTER VI

### THE USE OF RADIO IN PRIMARY AND SECONDARY FORMAL EDUCATION:

#### THE RADIO SANTA MARIA MODEL IN THE DOMINICAN REPUBLIC\*

Robert A. White

Radiophonic methods have been most widely known for their use in literacy and nonformal types of educational programs, but more recently radio is being introduced as a dimension of more formal education at advanced primary and secondary levels. One of the relatively successful models of formal education using a combination of radio, printed materials, and local guidance is that developed by ECCA (Emisoras Culturales Canarias) <sup>1/</sup> in the Canary Islands, Spain, and adapted by Radio Santa Maria in the Dominican Republic. This chapter describes the adaptation of the ECCA model by Radio Santa Maria for adult education at the primary and intermediate grade levels.

Material selected from a descriptive analysis and evaluation of the Radio Santa Maria system in 1975 and 1976 is presented here in five sections: (1) the background and objectives of the Radio Santa Maria program, (2) the educational methodology and administrative system, (3) a comparison of the costs of this system with the costs of conventional methods of adult education in the Dominican Republic, (4) an evaluation of the levels of academic achievement of the students, and (5) an evaluation of effectiveness in developing capacity for community participation and leadership. A final section summarizes the principal conclusions of the chapter.

#### 1. BACKGROUND AND OBJECTIVES OF THE RADIO SANTA MARIA SYSTEM

In the Dominican Republic, as in many other Third World countries, educational opportunities are notably lacking for rural lower-status groups. In this Caribbean country of approximately 4,000,000 inhabitants, 60 percent of whom are rural, 50.5 percent of the rural population twenty-five or older has had no formal education, and 89.7 percent of this age group has not completed four years of primary

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\* This chapter is an abstract of the full report, "An Alternative Pattern of Basic Education: A Case Study of Radio Santa Maria," to be published by the UIE and the IBE in the series, Experiments and Innovations in Education (Paris: UNESCO). This study will be published in English, French and Spanish.

education. In urban areas the corresponding figures are 22.4 percent and 57.9 percent, respectively. With one of the highest annual economic growth rates in Latin American from 1968 to 1975 (10 percent average), the Dominican Republic has dedicated increasing funds to the construction of classrooms and the hiring of teachers. However, in the period from 1964/1965 to 1974/75 primary school enrollment in rural areas increased by only 56 percent while in urban areas the increase was 136 percent. 2/ In 1969/70 only 12.6 percent of the rural primary schools had a sixth grade, and in rural schools the increase in the percentage of students persevering from the first to the sixth grade has been slow, from 1.6 percent in 1957/58 to 9.5 percent in 1971/72 (Oficina Internacional de Trabajo, 1975, p. 306).

Of the rural school teachers, 70 percent had no more than an eighth grade education in 1969/70, and 83 percent did not have sufficient professional preparation to carry out their work adequately. The adult education program maintained by the Secretariat of Education, using the day school facilities, reached a reported 40,000 enrollment in 1974/75, but except for a literacy campaign this program is limited almost entirely to towns and cities. 3/

In 1964 Radio Santa Maria, which operates as a ten kilowatt cultural-education station under the sponsorship of the Catholic Church in the north central part of the Dominican Republic, began a literacy program modeled after that of Radio Sutatenza (ACPO) in Colombia. Over a period of six years 25,459 adults received literacy certificates, and in conjunction with the radiophonic schools, programs of community development, small farmer agricultural associations, and cooperatives were promoted within the listening area of the radio station, which encompasses a population of approximately 1,500,000.

In 1970, Radio Santa Maria reevaluated the potential of its various programs for rural development in the Dominican Republic. This analysis indicated a widespread desire among young adults for more advanced formal education and suggested that the unstructured cultural programs and literacy campaigns no longer sufficed in the context of quickening modernization in both rural and urban areas. After studying various possible models, a complete reorganization of the adult education program was initiated based on the following seven objectives:

1. Provide an accelerated program of primary and intermediate education (grades one through eights), using radiophonic methods, in rural and lower-status urban neighborhoods throughout the country.
2. Coordinate the course content and examinations with the adult education system of the Secretariat of Education in the Dominican Republic so that graduates of this alternative pattern of education could receive the official



diplomas which enable them to enter secondary schools and have the same employment opportunities as graduates of the conventional system. While realistically accepting the strong motivation toward obtaining formal certificates and upward mobility, the curriculum is adapted to the psychology and life context of rural and urban lower-status groups.

3. Incorporate innovative instructional methods which enable students of a peasant background in an accelerated program to have levels of academic achievement as high as or higher than they would with conventional classroom methods.
4. In order to overcome the widespread dependence on passive, rote-memory methods of learning, emphasize the development of individual initiative in study, self-directed and self-evaluated learning, and analytic capacities in the young adult student.
5. Reformulate the curriculum (within the limitations of the primary and intermediate level courses) to achieve greater internal horizontal integration centered on problems arising out of the life context of the students (marginality, lack of socio-economic organization, and the economic dependency of lower-status groups). Radio Santa Maria has also explicitly emphasized the external horizontal integration of the formal, graded program with informal learning experiences in the community and at work, and especially with the general programming of the radio station.
6. Provide for a vertical integration of the primary and intermediate programs with further formal and informal learning experiences. Specifically, the graded program of Radio Santa Maria is designed to be the basis for and to be supplemented by a series of less formal educational programs in agriculture, health and nutrition, family relations and responsible parenthood, as well as training courses in community leadership which Radio Santa Maria itself sponsors.
7. Introduce special forms of efficiency in supervision and administration so as to reduce costs and avoid dependence on international financing for current operational expenses. Radio Santa Maria asks a student contribution of approximately US \$7.00 per course (\$.25 per week plus fees for enrollment and examinations), equivalent to four days' wages at the minimum wage levels normally paid in the Dominican Republic. Approximately 60 percent of the

annual budget is covered by student fees, 15 percent by a small government subsidy, and 25 percent by transfers from the radio station and from popular contributions.

In general, Radio Santa Maria has attempted to implement some of the principal guidelines of "lifelong education" suggested by the report of the International Commission on the Development of Education to UNESCO (the Faure report), Learning to Be (UNESCO, 1972; Dave, 1973).

The Santa Maria adaptation of the ECCA model combines six types of learning experience:

1. The basic educational aid provided for the student is a weekly set of six to eight attractively printed lesson sheets, one for each subject, carrying on one side an outline of the material to be explained in one week of radio broadcasts and on the other a series of written exercises. These lesson sheets, which over the twenty-three weeks of a course form a combination text and workbook, are distributed to the student each week for work in the home. Thus, the system of Santa Maria resembles a correspondence course with broadcast explanations and a weekly meeting with a field teacher.
2. Second in importance is a one-hour daily broadcast (Monday through Friday) explaining the material in the lesson sheets; one half hour is given to explanation and one half hour to working the exercises.
3. Supplementing the lesson sheets and daily broadcasts is a field teacher who is to correct the written exercises, answer student questions, and detect weaknesses of individual students so that help may be given if necessary. The field teacher also performs administrative tasks of enrollment, giving examinations, and forwarding student fees to the central office. Through the field teacher, the student receives personal guidance in his or her own studies.

It should be noted that the field teacher does not form a local "radiophonic school," since the students receive the classes in the home, but rather a "sector" which is primarily a flexible unit for administration and guidance and may include students from surrounding communities as far as ten kilometers distant.

4. As a communitarian dimension of the learning process, the field teacher holds a weekly meeting with the students of his or her "sector" to answer questions in a group

context, explain material which is a problem to the whole group, provide general reviews for examinations, and give the examinations. An important part of this weekly interchange is the discussion of a social question which has been the "central theme" of the various subject matters during the week.

5. Radio Santa Maria provides other general cultural and educational radio programs for different age and occupational groups which are designed to provide a cultural and educational support to the more formal educational process.
6. Although Radio Santa Maria maintains no staff for promoting organizations at the community level, its educational programs work through existing organizations, and the activities of these organizations are looked upon as an extension of the more formal educational courses. It is expected that students of Radio Santa Maria will consider active participation and leadership in community organizations part of their education. According to a survey in 1975, some 60 percent of the students were participating in some community organization, especially in the neighborhood youth clubs.

Over a period of five years Radio Santa Maria has expanded to virtually all parts of the Dominican Republic, including lower-status areas of the capital, Santo Domingo. Since the scholastic year 1972/73, the yearly enrollment over eight grades has averaged approximately 21,000 students, and the number of students promoted averages about 12,000 to 13,000 annually (see Table 1). Although statistics for the 1975/76 year are incomplete, Radio Santa Maria (henceforth abbreviated to RSM) expected to graduate more than 4,000 from the eighth grade in July of 1976. The RSM program has found its greatest response among young rural adults (the median age of its students is less than 18) who have finished all of the primary grades available in their community (usually to the fourth grade) and then continue on through the eighth grade in the RSM system.

The central office is maintained in the heavily populated rural area of the Cibao valley (in the city of La Vega), but regional administrative offices have been established in the capital, Santo Domingo, and in the Haitian frontier region. Five commercial and religious stations collaborate with RSM in broadcasting the radiophonic classes. RSM has its own offset press and other equipment for the printing, folding, and other preparation of the lesson sheets and numerous other publications which always accompany its formal and nonformal educational programs.

Table 1

Initial Enrollment and Number of Students Promoted at End of Course in the Basic Education Program of Radio Santa Maria from 1971/1972 to 1974/75

| Grades  | 1971/1972          |                    | 1972/1973          |                    | 1973/1974          |                    | 1974/1975          |                    |
|---------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|         | Initial Enrollment | Student Promotions | Initial Enrollment | Student Promotions | Initial Enrollment | Student Promotions | Initial Enrollment | Student Promotions |
| First   | --                 | --                 | 1,017              | 463                | --                 | --                 | --                 | --                 |
| Second  | 1,335              | 603                | 1,030              | 467                | --                 | --                 | --                 | --                 |
| Third   | 1,018              | 358                | 2,504              | 1,201              | 2,657              | 960                | 2,385              | 931                |
| Fourth  | 3,759 <u>a/</u>    | 1,643              | 2,495              | 1,314              | 2,245              | 962                | 2,465              | 1,187              |
| Fifth   | 2,674 <u>a/</u>    | 1,353              | 3,598              | 2,214              | 5,447              | 2,582              | 4,521              | 2,878              |
| Sixth   | 3,452              | 1,856              | 4,605              | 3,110              | 4,321              | 3,061              | 4,789              | 3,234              |
| Seventh | --                 | --                 | 2,903              | 2,277              | 3,636              | 1,949              | 3,238              | 1,637              |
| Eighth  | --                 | --                 | 4,223              | 2,869              | 1,865 <u>b/</u>    | 972 <u>b/</u>      | 2,711              | 2,069              |
| Total   | 12,238             | 5,813              | 22,375             | 13,915             | 20,171             | 10,476             | 20,109             | 11,936             |

a/ Represents two courses in one year.

b/ In the scholastic year 1973/1974 the Secretariat of Education requested that Radio Santa Maria extend its courses at the intermediate level (seventh and eighth grades) from six months to a full scholastic year. Since seventh grade students in the first semester could not pass to eighth grade in the second semester, as had been done previously, eighth grade enrollment dropped in 1973/1974 and in 1974/1975. The permission for six month courses at the intermediate level has been restored beginning with the first semester of 1976.

## 2. EDUCATIONAL METHODOLOGY AND ADMINISTRATIVE SYSTEM OF RADIO SANTA MARIA

The RSM system proposes very broad and innovative educational objectives. To provide an overview of how radio is adapted to achieve these objectives effectively and at low cost, five aspects of the educational and administrative methods will be described: (1) curriculum content, (2) methodology used in the radio broadcasts and printed materials, (3) how printed materials are distributed to students on a weekly basis, (4) the field teacher method, and (5) the system of field supervision and central administration.

### 2.1 The Internal and External Integration of Curriculum Content: The Central Theme Method

The RSM system follows the official primary and intermediate programs for adults: Spanish language, Spanish grammar, mathematics, natural sciences, social studies, Dominican economy in the sixth grade, and English in the seventh and eighth grades. With a very judicious selection of materials, the active method in study, and the more rapid comprehension of young adults, each course is covered in a little less than six months, so that the students may finish the eight grades in four years.

To achieve greater internal integration of the subject matter and relate the formal education experience to the largely rural life context and to the social problems faced by young adults in a rapidly changing society, RSM has introduced the central theme method.

For each six month semester a theme is selected representing an area of human values or a social question currently relevant in the Dominican Republic. This forms the integrating focus of the various subject matters in all of the grade levels of that semester (first, third, fifth, and seventh grades in the first semester and second, fourth, sixth, and eighth grades in the second semester). For example, the central theme for the first semester of 1975/76 discussed various forms of human dependence and liberation in the socio-cultural context of the Dominican Republic, from the liberation of women to the liberation of peasants from the exploitation of economic intermediaries.

One of the weekly lesson sheets presents the explanation of the central theme for that week, and the opening broadcast class on the first day of the week explains the theme for that week--frequently with a short radio drama. Throughout the week's classes each of the subjects is developed around the central theme, either in the examples or in the substantive matter. At the end of the week, in the meeting of the field teacher with the students, a discussion on the central theme is held with the field teacher serving as animator. Ideally, the discussion becomes a reflection on the institutions and cultural values of the



local community. A secretary records the conclusions of the discussions, and the field teachers are asked to send occasional reports on these conclusions to the central office so that they may be discussed on the weekly radio program for the field teachers. In addition, many points of the central theme are taken up on the less formal daily educational programs of RSM.

The central theme method represents a significant curriculum reform within the official curriculum requirements and requires re-training of the central teaching staff as well as the field teachers who are to moderate weekly discussions. Also, students who have begun their education with traditional curricula and enter the system perceiving education as terminating in a certificate must be gradually introduced to a new perspective of learning in which "lifelong education" is the guiding principle.

## 2.2 The Composition of the Weekly Lesson Sheets and the Daily Broadcast Classes

Each week the student receives in the meeting with the field teacher a packet of eight sheets--one for each subject and the central theme--which services as the text, exercise workbook, class chart, and blackboard. The lesson sheets have a series of small completion exercises built into the presentation--a word to be underlined or written into the text, a small diagram to be completed, or a deliberate small mistake which the broadcast dialogue helps the student to detect and correct. The lesson sheets make considerable use of special visual effects: drawings related to the life context of the students, diagrams, and a careful organization of the material so that the student is easily guided through the subject matter and the whole presentation leads to one logical impression.

The broadcast classes are based on a male-female team engaged in a conversation in which one party asks a series of questions and the other party plays the role of the inquiring student working with the lesson sheets. The broadcast teachers use no written guides. The spontaneous animated conversation of questions and answers with an occasional little joke between a young male and female voice establishes a pleasant one-to-one relationship with the student and a level of personal involvement which is difficult to reproduce in a large class context. Some subjects lend themselves to a short radio drama with special sound effects and musical background which the studio technician inserts at the time of the final mounting of a tape for later broadcast.

Both the lesson sheets and the broadcast classes are designed to involve the student in an active audio-visual experience with continuous written and oral expression. The student does not simply memorize information but, with the broadcasting teacher, discovers information, integrates this into an existing structure of knowledge, and gains a positive self-image as an active agent of learning and creating.

The broadcast classes are received by the students in the home, which eliminates the necessity of walking to a central place and emphasizes the responsibility of the student in organizing his or her learning experience.

Since RSM maintains a series of educational or entertainment programs which appeal to different audiences throughout the day, the radiophonic classes are limited to four half-hour presentations each evening from 7:00 to 9:00 p.m. Each grade level has a total of one hour of class and guided study each evening, divided between four seven-minute periods of subject matter and four periods of working the exercises on the reverse side of the lesson sheets.

For the composition of the lesson sheets and the broadcast classes, RSM has a director, five or six teachers, and an artist. Although it would be possible to develop one final edition of the lesson sheets, RSM has preferred to produce a new set each year, incorporating the feedback from the weekly reports of the field teachers, the visits of teachers to the sectors, the reports of students, and the results of examinations in order to continually improve the study materials. The lesson sheets are thoroughly contemporary, and the central theme is thus easily related to current events in the country.

Most of the teachers specialize in a subject area over a series of grade levels achieving greater vertical integration of material, but the teaching staff works as a team, especially for the integration of subjects around the central theme.

### 2.3 Distributing the Weekly Lesson Sheets to the Students

Although a complete set of lesson sheets could be distributed to the field teacher at the beginning of the semester, with the teacher giving materials to the student week by week, RSM has preferred to distribute the lesson sheets on a weekly basis. As is noted below, the field teacher is required to send in a weekly report with the exact number of students--discounting withdrawals and adding new students entering during the semester. Thus RSM can print and distribute the exact number of lesson sheets which are needed for that week, at a considerable reduction of costs for paper and printing. Once the weekly tally of each sector is in, this is passed to the printing department, which prints and prepares in separate packages the lesson sheets needed for the different grade levels in each sector. Since the postal system does not function in rural areas with the necessary efficiency, RSM sends a jeep around an established one-day circuit, delivering the packets of lesson sheets to some easily accessible central point where the field teacher can pick up the lesson sheets at least the day before the weekly interchange. In the case of the sectors dependent on the more remote regional field offices, the lesson sheets are delivered in bulk by public transportation to the field offices, where they are packaged and delivered to the points accessible to the field teachers.

#### 2.4 The Field Teachers and the Weekly Group Interchange

Once a week, usually on the weekend, the student meets with the field teacher to hand in the lesson sheets for correction, ask questions regarding doubts that remain after the broadcast classes, engage in a group discussion of the central theme, receive the lesson sheets the field teacher has corrected from the past week, and, finally, pay the US \$.25 weekly fee and receive the following week's lesson sheets. The field teacher plays a most important role in the ECCA system, because he or she sets the tone of study for the sector, provides the element of personal guidance that students need, and is the role model for the integration of formal education with the personal values and community participation of the students.

Field teachers are required to have (1) an academic level at least two years above the grade level being taught, (2) the personal maturity and reliability to carry out the local administrative duties such as collecting fees and passing these to the central office, and (3) a demonstrated leadership in the community in order to link the formal lessons with broader community activities.

Although the ECCA system in the Canary Islands prefers the local public school teacher as a field teacher, RSM has found that some of its best field teachers are young (like the students), frequently secondary school students who are leaders in youth organizations of the area. The small remuneration of US\$.15 which the field teacher keeps from the weekly fee of US\$.25 compensates for the six to ten hours spent on this each week, but the main motivation is community service.

In organizing a network of field teachers, an attempt is made to locate them in places of easy access so that each student can find a field teacher at least in a nearby community. Also, if a student must migrate to another part of the country during a course, he or she can usually find a field teacher near the new location and so will not need to give up the course. Although RSM provides a detailed instruction booklet and is beginning short training courses for field teachers, much of the training is "in service" through a system of circular letters sent out with the weekly lesson sheets, a weekly instructional radio program, and the occasional visits of the field supervisor.

The field teacher has six main duties:

(a) Enrolling Students

Field teachers fill out the initial enrollment cards which form the basis of the student's permanent record and forward them to the central office. Enrollments are held open for at least one-third of the course, and

students may enter at any grade level they think they are capable of following. The only requirement is that students be at least fourteen years old (unless there is no alternative educational opportunity easily available) and that students at the intermediate level show a primary school certificate.

(b) The Weekly Interchange

In a sector with the average of twenty students per semester, the field teacher is expected to set aside at least two hours for answering questions and for leading the discussion of the central theme. If students do not attend the interchange, they may be asked to withdraw.

Field teachers are also expected to be unconditional in not distributing the next week's lesson sheets if the US \$.25 weekly fee is not paid. Experience has shown that students generally have a much stronger commitment to serious study if the field teacher is more careful in requiring the regular payment of the fees. Field teachers and other observers report that the weekly fee is generally not an obstacle to potential students except in the 15 to 20 percent of the families where there is unemployment. For these students a special "hardship fund" may be established.

(c) Correcting the Student Exercises on the Lesson Sheets

If the field teacher is faithful in correcting the exercises, it is possible to maintain a continuous diagnosis of student progress (or lack of it) so that problems may be solved before the student becomes discouraged and withdraws.

(d) The Weekly Report

On the Monday following the interchange, the field teacher is expected to send in to the central records department or to the office of the regional subcenter by mail or whatever means is convenient, a form stating the exact number of lesson sheets needed for each grade the coming week. On this form is noted the enrollment of the former week, the newly enrolled students, and the withdrawals. Thus, the central office knows exactly from week to week how many students are enrolled in each grade.

Since the field teacher must pass to the central office US \$.10 for each set of lesson sheets sent out or return the excess lesson sheets to the central office, it

is in the interest of the field teacher to know as quickly as possible that a student is withdrawing and to avoid the trouble of sending back lesson sheets or paying for them out of his or her own pocket.

The weekly report form also has a space for other comments, and the field teachers are asked to note especially the problems the students are having with the lesson sheets and the broadcast classes or other problems. On the basis of these weekly reports, immediate adjustments in the instructional materials or other aspects of the program may be made.

(e) Passing Collected Fees to the Central Office

Once a month the central records department sends to the field teacher a statement detailing how many students are reportedly enrolled in the sector, the number of lesson sheets and examinations sent out, and the exact amount which is to be sent by mail or delivered personally to the central or regional office. If a field teacher allows the bills to go unpaid for two months, he or she is invited to the central or regional office to sign a contract for regular payments. If the field teacher is completely disorganized in the payments, this is usually associated with a general state of disorganization in the sector, and steps are taken to replace the field teacher. As long as the central records department is prompt in detecting negligence, there are rarely serious problems, and over the years the default (discrepancy between lesson sheets sent out and payments made) is about 15 percent.

(f) Giving the Examinations

The field teacher is responsible for giving a review before the examinations, administering the two examinations sent out from the central office during each course, correcting these examinations with the help of an answer guide, recording the grades on a special form, and forwarding these grades to the central records department for the permanent grade record of the student.

In the case of the general examinations at the end of the primary school (sixth grade) and the intermediate level (eighth grade), for which officially recognized certificates are issued by the Secretariat of Education, the field teacher must assemble the required witnesses and follow the procedure stipulated by the Secretariat of Education. For the official certificate, grades and



recommendations for passing or failing are submitted to the Secretariat of Education by the central records department of RSM.

## 2.5 Field Supervision and Central Administration

RSM is able to maintain an acceptable level of responsibility and effectiveness in the more than 520 field teachers and 12,000 students enrolled each semester with a total field supervisory staff of six (including the regional offices) because of its methods of selecting and motivating field teachers, the system of weekly and monthly reports to the central records department, and the careful coordination of the work of field supervisors with the central records department.

### (a) Support of Collaborating Organizations

RSM generally introduces the basic adult education program through private voluntary organizations such as the youth clubs looking for a "project," the local parish of the Catholic Church, systems of cooperatives, or the local school teacher. Since these organizations do much of the promotional work, help select good candidates, and feel an overall responsibility for the success of the sector, this reduces the supervisory responsibility of the central office.

### (b) Mutual Commitment of Students and Field Teacher

Since the students are paying a small fee and know well what the duties of the field teacher are, they are often the first to report to the central office by letter or direct visit when a field teacher is not providing the service expected. And since the field teacher is not purely a volunteer, both students and the central office are in a position to demand more exact performance.

### (c) Centralized Supervisory System

The major work of supervision is carried out by the central records department, which is steadily receiving the enrollments, the weekly reports, the examination results, and the monthly payments from the field teachers. When the central records department detects the possibility of a problem in a sector, the field supervisors are asked to visit the sector and attempt to help the field teacher or, if necessary, begin the process of selecting candidates for a replacement.

(d) The Circular Letters for Field Teachers

If the field teachers do not pay careful attention to the circular letters sent out with the weekly lesson sheets and to the weekly instructional radio program for field teachers, problems begin to develop with student expectations. With these continuous instructions from the central office, field teachers may be kept regularly informed with fewer meetings or personal visits.

(e) Direct Contact of Field Supervisors

The field supervisors generally hold zone meetings with field teachers at least once a semester and attempt to visit each sector at least once a year (or more often if there are problems).

The administrative system of the formal adult education program consists of four departments: (1) the teaching staff (six teachers and an artist), (2) central records (four secretaries), (3) field supervision (six including the personnel of two regional offices), and (4) printing and distribution (printer, two assistants, and a driver). These four departments operate under the general director of the formal education program (the radiophonic school), who is also responsible for curriculum content and relations with the Secretariat of Education. The policy and planning of the formal education program is carried out by the director and the teaching staff in consultation.

RSM also has a director of the nonformal education program and a director of the general programming of the radio station. The directors of the three major programs of RSM are coordinated by a general administrator of RSM, who also personally directs a small fund for loans and the distribution of purebred livestock (pigs, goats, and rabbits) to small farmer agricultural associations promoted by RSM. The overall policy and planning of RSM is formed in a general council made up of the directors of the three major programs and the general administrators. 4/

### 3. COSTS

RSM has employed four basic principles which contribute to the reduction of costs: (1) simplicity of administrative functions so that a central office can be staffed with personnel of ordinary capacity (that is, without unusual talents or training); (2) concentration of supervision in a central office with systems of continual feedback from the field to reduce the need for direct field supervision; (3) a relatively systematized set of functions, so that under conditions of a

reduced budget, one person can carry out several administrative functions; (4) a design which permits expansion of enrollment without increasing administrative and supervisory personnel, thereby keeping down overhead costs per student.

The actual expenditures of RSM on the formal adult education program--including all salaries, paper, utilities, etc., but excluding the US \$3.85 which the field teacher receives for each student in each six-month course--in the calendar year of 1975 was US \$85,400. With 20,109 students enrolled in the two semesters of 1975, the expenditure per student enrolled was US\$4.25. With the number of students promoted about 60 percent of those enrolled, the cost per student promoted was US \$7.15.

In addition to the principles of administration mentioned above, RSM has been able to work out a series of cost-reducing measures which are to be recommended to public and private agencies although they may be difficult to imitate. For example, the central office is maintained in a provincial city where salaries and other services are more economical, the broadcasting time and studios are contributed by Radio Santa Maria and collaborating stations, and special arrangements are made for purchase such as paper.

The real costs of the RSM system--if one includes the payment of field teachers, broadcasting time, depreciation, a larger number of personnel, somewhat higher salaries, and a series of other expenditures which might be incurred if this system were operated by a public agency--are calculated at US \$24.31 per student enrolled per calendar year (two grade courses) with 20,000 students. If the enrollment were to rise to 40,000 in the RSM radiophonic system, the real costs per student would drop to about US \$20 per student enrolled. 5/

However, the real costs of the conventional classroom system of adult education of the Secretariat of Education in the Dominican Republic--with approximately 40,000 students enrolled in 1974--are US \$38.90 per student enrolled and US \$62.44 per student promoted.

Thus, the RSM model, by using radiophonic methods and simple efficiencies, not only reaches students in ordinarily inaccessible rural areas, but can do so at approximately half of the real cost for the conventional system. Moreover, many of the special cost-reducing mechanisms presently used by RSM could probably be implemented by public agencies so that their real costs would be somewhere in between the \$4.25 actual expenditure per student and the \$24.31 estimated real costs.

The major cost advantage of the RSM system is that the need for a large staff of trained teachers and school buildings is eliminated and a large field supervisory staff is not necessary. While the costs per student of conventional systems remain constant or increase with the

expansion of enrollment, the costs per student in the RSM model, which depends on more centralized teaching and supervision, are sharply reduced with increased enrollment.

With such reduced costs, 60 percent of expenditures can be financed by student fees and the rest by sources of funds within the country. RSM has, thus far, sought funds from international agencies only for initial investments such as buildings, equipment, and training courses and has avoided excessive dependence on international sources, so that there is greater liberty in policy making.

#### 4. EFFECTIVENESS: ACADEMIC ACHIEVEMENT

In a study carried out in 1975, the same official sixth and eighth grade certificate examinations were given to a random sample of 33 sectors of RSM with 464 examinees and to a corresponding random sample of 12 schools with 324 examinees in the conventional classroom system of the adult education program of the Secretariat of Education. It was recognized that in this measure of the levels of academic achievement, RSM students would be at a disadvantage, because the course content of RSM, while following the official curriculum, is adapted to the needs of rural adults, and the examination ordinarily used by RSM students has a somewhat different format. 7/ Also, 80 percent of the RSM students in the sample were of rural (peasant) background, while the students in the conventional system were entirely urban at this grade level. 7/

In spite of these disadvantages in the testing, it was found that in the district where the field teachers of RSM were functioning at an adequate level, the median examination scores of RSM students at both sixth and eighth grade levels were higher in all subjects than similar students in the system with conventional methods (see Tables 2 and 3). In the district where the field teachers of RSM were notably weak, the median scores of RSM students at the sixth grade level were about the same as students in the system with conventional methods, but RSM students at the eighth grade level in this district had lower median scores in all but one subject.

The study was helpful in pointing up the key importance of the field teacher in the ECCA system, especially in subjects such as mathematics where more exercise and personal guidance may be necessary. Since the study, RSM has been able to improve the level of field teachers, and it is expected that levels of academic achievement will be more evenly high throughout the system.

The study also revealed that in the district with adequate field teachers, longer periods of enrollment were positively correlated with higher levels of academic achievement. This suggests that greater exposure to the RSM method will progressively improve levels of academic achievement.



TABLE 2

Comparison of Median Examination Scores of Sixth Grade Students in Schools with Radiophonic and Conventional Classroom Methods a/

| Subject           | Number | Radiophonic Students          |                  |                      |                 | Conventional Classroom Students |                               |                  |                      |                 |
|-------------------|--------|-------------------------------|------------------|----------------------|-----------------|---------------------------------|-------------------------------|------------------|----------------------|-----------------|
|                   |        | Percent<br>Less<br>than<br>60 | Percent<br>60-79 | Higher<br>than<br>80 | Median<br>Score | Number                          | Percent<br>Less<br>than<br>60 | Percent<br>60-79 | Higher<br>than<br>80 | Median<br>Score |
| Spanish Language  | 111    | 5.4                           | 71.2             | 23.4                 | 74.6            | 107                             | 13.0                          | 71.1             | 15.9                 | 71.9            |
| Spanish Grammar   | 108    | 32.4                          | 51.9             | 15.7                 | 65.8            | 107                             | 51.4                          | 39.3             | 9.3                  | 59.3            |
| Mathematics       | 111    | 64.0                          | 34.2             | 1.8                  | 53.3            | 107                             | 75.7                          | 22.4             | 1.9                  | 50.8            |
| Natural Sciences  | 111    | 16.4                          | 71.8             | 11.8                 | 69.0            | 105                             | 32.4                          | 60.0             | 7.6                  | 65.0            |
| Dominican Economy | 110    | 48.2                          | 47.3             | 4.5                  | 60.6            | 105                             | 62.8                          | 32.4             | 4.8                  | 54.6            |
| Social Studies    | 110    | 20.0                          | 30.9             | 49.1                 | 79.5            | 105                             | 21.9                          | 57.1             | 1.0                  | 68.9            |

a/ Table 2 presents the examination scores of sixth grade students in District I, where the field teachers of RSM in this sample were found to be functioning at adequate levels. See footnote 8, page 21.



TABLE 3

Comparison of Median Examination Scores of Eighth Grade Students in Schools with Radiophonic and Conventional Classroom Methods a/

| Subject             | Number | Radiophonic Students          |                  |                      |                 | Number | Conventional Classroom Students b/ |                  |                      |                 |
|---------------------|--------|-------------------------------|------------------|----------------------|-----------------|--------|------------------------------------|------------------|----------------------|-----------------|
|                     |        | Percent<br>Less<br>than<br>60 | Percent<br>60-79 | Higher<br>than<br>80 | Median<br>Score |        | Percent<br>Less<br>than<br>60      | Percent<br>60-79 | Higher<br>than<br>80 | Median<br>Score |
| Spanish<br>Language | 48     | 2.1                           | 56.2             | 41.7                 | 78.4            | 57     | 1.7                                | 72.0             | 26.3                 | 76.2            |
| Spanish<br>Grammar  | 49     | 32.7                          | 63.3             | 4.0                  | 65.3            | 57     | 40.3                               | 59.7             | —                    | 63.1            |
| Mathe-<br>matics    | 48     | 58.3                          | 22.9             | 18.8                 | 53.3            | 57     | 61.4                               | 26.3             | 12.3                 | 51.9            |
| Natural<br>Sciences | 49     | 44.9                          | 36.7             | 18.3                 | 63.1            | —      | —                                  | —                | —                    | —               |
| English             | 48     | 14.6                          | 52.1             | 33.3                 | 70.0            | —      | —                                  | —                | —                    | —               |
| Social<br>Studies   | 49     | 40.8                          | 32.6             | 26.5                 | 64.5            | —      | —                                  | —                | —                    | —               |

a/ Table 3 presents the examination scores of eighth grade students in District I, where the field teachers of RSM in this sample were found to be functioning at adequate levels. See footnote 8, page 21.

b/ Examination papers in three subjects were disqualified because of irregularities in the procedures of the examinations.

In a second part of the evaluation of academic achievement of RSM students, the grade averages of 98 eighth grade graduates of RSM now in secondary schools were compared with the average of the class in which RSM students are now enrolled. The sample included all of the RSM graduates in six public and private secondary schools leading to the bachillerato. As might be expected, some RSM graduates were below their class average, but the total group of 98 RSM graduates tended to be slightly above their class average in the secondary school. This indicates that the RSM system adequately prepares its students who wish to continue their studies in the general educational system.

These studies provide evidence that students in the RSM system can generally be expected to have levels of academic achievement equal to or higher than students in conventional educational systems, even when the RSM students are largely of a rural, peasant background.

##### 5. EFFECTIVENESS: DEVELOPMENT OF CAPACITY FOR COMMUNITY PARTICIPATION AND LEADERSHIP

Although this formal program of RSM is oriented toward a series of very basic educational skills, participation in community organizations is considered an extension of the formal learning experience, and the central theme methodology attempts to develop a greater awareness of rural socio-economic problems and a capacity for community leadership.

In a study of the role of RSM in the process of attitude and value change in rural areas of the Dominican Republic, a randomly selected sample of 89 students (or former students) of the formal education program were included in the total sample of 438 in four rural communities. In this study it was possible to compare RSM students with varying periods of enrollment (and, supposedly, with different degrees of exposure to the influence of this educational program on attitudes and capacities) with the general rural population. Although the study analyzed levels in information, values, and overt behavior on a series of dimensions (agriculture, health, community participation, and family relations), five areas of capacity for community leadership were selected for comparison of RSM students and non-students.

Table 4 indicates that on five measures of capacity for community leadership, RSM students with longer periods of enrollment tended to have consistently higher mean scores than the general population in their rural communities.

However, a closer analysis of these results using multiple correlation techniques reveals that the higher scores of RSM students are influenced by a series of factors, not just their enrollment in the adult education programs of RSM. Because of their formal education they

TABLE 4

Comparison of Mean Scores of Radiophonic Students on Measures of Capacity for Community Leadership with Mean Scores of Rural Population Never Enrolled in Radiophonic Schools a/

| Measures of Capacity<br>for Community<br>Leadership | Length of Enrollment in Radiophonic Schools |               |                                               |               |                            |                 |                             |                |                                          |                 |
|-----------------------------------------------------|---------------------------------------------|---------------|-----------------------------------------------|---------------|----------------------------|-----------------|-----------------------------|----------------|------------------------------------------|-----------------|
|                                                     | Never<br>Enrolled<br>in Radio<br>School     |               | Enrolled<br>but Did Not<br>Complete<br>Course |               | Completed<br>ONE<br>Course |                 | Completed<br>TWO<br>Courses |                | Completed<br>THREE<br>or More<br>Courses |                 |
|                                                     | Number                                      | Mean<br>Score | Number                                        | Mean<br>Score | Number                     | Mean<br>Score   | Number                      | Mean<br>Score  | Number                                   | Mean<br>Score   |
| 1. Awareness of community problems                  | 339                                         | 5.62          | 32                                            | 5.59          | 31                         | 6.58 <u>b/</u>  | 22                          | 6.31           | 14                                       | 7.14 <u>c/</u>  |
| 2. Awareness of solution to problems                |                                             | 14.15         |                                               | 12.94         |                            | 14.74           |                             | 15.45          |                                          | 16.07 <u>b/</u> |
| 3. Taking initiative in leadership                  |                                             | 7.61          |                                               | 7.72          |                            | 8.90 <u>c/</u>  |                             | 8.50 <u>b/</u> |                                          | 9.43 <u>b/</u>  |
| 4. Knowledge of how to manage organizations         |                                             | 4.48          |                                               | 4.44          |                            | 5.77            |                             | 5.22           |                                          | 6.93 <u>d/</u>  |
| 5. Religious motivation toward structural change    |                                             | 15.12         |                                               | 15.44         |                            | 17.45 <u>d/</u> |                             | 16.18          |                                          | 17.93 <u>c/</u> |

a/ Comparisons are between the group "never enrolled in radio school" and groups with different periods of enrollment. Probability levels are based on Student's "t" test, two-tailed tests of significance.

b/  $p < .05$ .

c/  $p < .01$ .

d/  $p < .001$ .

tend to be selected for community leadership positions more frequently, and once occupying these leadership roles they learn a series of new capacities. Also, they are more likely to receive leadership training courses, and they listen to nonformal educational radio programs such as the University for All; both of these are important factors in capacity for community leadership. Although it appears that the formal education of RSM is not so significant as a direct factor in developing leadership capacity, it is an indirect factor bringing young people in rural communities into other informal learning experiences which do develop leadership capacities. This, in a sense, vindicates the thesis of RSM: that the formal education process is incomplete if it is not integrated with other nonformal learning experiences and with participation in community organizations.

The central theme method of RSM may eventually become more directly effective, insofar as the themes are generated from the concerns of the student population, there is greater integration of the central theme with the various subject matters, and there are special training courses for the field teachers giving them greater interest and skill in directing the weekly discussions of the students.

## 6. CONCLUSIONS

The Santa Maria adaptation of the ECCA system offers an alternative and, in many respects, innovative pattern of formal education for countries at every stage of development. Although there are many variations of the methods incorporated by RSM, a number of the adaptations made by RSM demonstrate significant advantages over conventional educational methods.

### 6.1 Making Educational Opportunities Available to Marginal Groups

In many countries large segments of the population are deprived of an opportunity for basic formal education at the primary and secondary levels simply because this is conceived of in terms of buildings and teachers in classrooms. The RSM experience is valuable because it demonstrates that a quality education for adolescents and young adults may be rapidly extended throughout the country without large investments in buildings and in the training of thousands of teachers and supervisors. Although some field teacher guidance is an important aspect in the ECCA-RSM system, the fact that RSM in the Dominican Republic--with few educated people in rural areas--is developing a quite different system of field teachers than the original ECCA system in the Canary Islands indicates that a great deal of flexibility is possible according to the resources of the particular country.

## 6.2 Supplementing the Existing Educational Facilities

Even if a country has well-developed primary and secondary educational facilities, many adults want to finish their education or take advantage of new opportunities within a flexible system that permits them to study in their homes and at the hours they have available. The system described here has many advantages over simple correspondence courses. Obviously there is no limit to the types of courses which may be offered. ECCA in the Canary Islands provides, in addition to the primary and intermediate level, courses in English, a program in business administration, and one in family relations. The institutional responsibility in life-long education is to determine the educational needs and specific motivations of different population segments and respond to them in the most flexible manner possible--not to expect the individual to respond to the institution.

## 6.3 Equal or Higher Levels of Academic Achievement

The fears of some educational administrators that students in alternative patterns of education such as that of RSM will not have levels of academic achievement as high as those of students in conventional classroom contexts are shown to be unfounded. Even though the majority of the students taught by the RSM method have the cultural disadvantage of a rural, peasant background, they tend to have levels of academic achievement equal to or higher than students of urban background taught by conventional methods. The grade average of RSM graduates now in secondary schools are also equal to those of secondary students coming from conventional educational institutions. This finding regarding academic achievement of RSM students is corroborated by other studies of effectiveness of public and private educational systems which have used the radiophonic methods (Spain, 1973; Schmelkes de Sotelo, 1973).

The major reasons for the RSM model's effectiveness appear to be that students have access to a superior level of instruction through the broadcast classes of a central teaching staff, and they have the advantage of a combined text and exercise booklet. (Most students in the general primary-intermediate system as well as in the adult education program in the Dominican Republic do not at present have texts but copy from blackboard notes of the teacher.) The field teacher, freed from the necessity of presenting a class, can give more time to individual student diagnosis and guidance.

The fact that RSM has developed an effective central teaching staff with personnel recruited in a small provincial city of the Dominican Republic indicates that, with the models available, artfully preparing the lesson sheets and broadcast classes is easily within the capability of most public and private educational institutions.



#### 6.4 Horizontal and Vertical Integration of Curriculum is More Easily Achieved

Most curriculum reforms which attempt greater internal integration of the subject matter, vertical integration between educational levels, and relationship between formal education and informal learning experiences bog down because it is necessary to virtually retrain thousands of teachers, and because the educational establishment is separated from the rest of the community.

The RSM method has the advantages of working with a small central teaching staff, of using a system of continually revising and adapting instructional materials on the basis of feedback from the field, and of approaching the student through community organizations. RSM is still developing its method of internal and external integration through the central theme. Even a small central teaching staff must thoroughly rethink its handling of traditional curricula, and some training of the field teacher is necessary. Also, any kind of real curriculum reform is difficult if the socio-political context of the country does not support it. Nevertheless there is evidence that the method can relate education to the life context of adolescents and young adults.

The attempt to link formal education with activities of community organization places greater demands on the time of the field supervisors. Radio Santa Maria has opted to have a small field staff in order to keep costs within budget restraints and thus tends to have less effectiveness in this area. Radiophonic systems in Latin America, such as ACPH in Honduras, which have made formal education programs successful instruments for developing rural organizations (community development, cooperation, and national peasant organizations), have generally needed a larger field promotional staff (White, 1972; 1977).

#### 6.5 Emphasis on Student Initiative and Activity

A central aspect of the ECCA-RSM system is that emphasis is shifted from the teacher or institutional initiative to student initiative, so that the student learns not to depend so greatly on an institutional structure for learning experience. The advantage of this is brought out by Philip Coombs:

The heavy reliance on face to face oral instruction has absorbed the bulk of resources in staff costs--leaving little or nothing for other aids to learning--and caused them to become the main bottleneck to expanding learning opportunities. . . . It has also wasted the greatest educational resource of all--the extraordinary capacity of motivated people to learn on their own when given easy access to the stuff of learning (1974, p. 171).

## 6.6 Balanced Personal Growth of the Individual

The combination of six different learning experiences in the RSM system goes far beyond most conventional classroom systems in providing an integral education, and it is precisely the flexibility of the RSM system which permits this kind of development.

## 6.7 Introduction of Cost-Reducing Efficiencies

One of the major obstacles to rapid extension of educational opportunities is the expensiveness of present methods, so that the cost of extending educational opportunities to all children of school age is often beyond the public budget capacities of developing countries. Even radiophonic systems in Latin America have become more expensive than originally projected. The principles of more centralized teaching through radio and of centralizing administration and supervision (maintaining, at the same time, a continuous response to feedback from the field) could reduce costs very much in both public and private educational institutions.

## 6.8 Supporting Educational Reforms with Reforms in the Overall National Development Policy

As a final note it must be emphasized that although alternative systems such as Radio Santa Maria may attempt to have a much broader educational impact than conventional methods, their real effectiveness and long-range benefits depend very much on the general structural context which national development policy creates. An educational program may have as an objective raising the educational level and general quality of life in rural areas, but if the official economic development policy does not include agrarian reform, programs of effective rural credit, and marketing opportunities, the rural area will suffer a continuous economic depression. Without economic opportunities in rural areas, improved educational opportunities will only force an increased "desperation" emigration to urban areas. Again, attempts to integrate formal education with participation in community organizations can only lead to frustration if the official policy tends to repress local leadership and rural organizations or does not respond to grass-roots efforts to solve problems by granting outside resources. Educators must face the reality that educational aspirations and the ideals of lifelong education are in great part responses to the opportunities which the overall national policy creates.

#### REFERENCE NOTES

1. A recent report describing in detail the ECCA system in the Canary Islands is now available from Luis Espina Cepeda, Radio ECCA, Apartado 994, Las Palmas de Gran Canaria, Spain.
2. Based on data provided by the Departamento de Estadística, Secretaría de Educación, Bellas Artes y Cultos, Santo Domingo, República Dominicana.
3. Based on data provided by the Dirección General de Educación de Adultos, Secretaría de Educación, Bellas Artes y Cultos, Santo Domingo, República Dominicana.
4. Although some of the program directors of RSM have been lay professionals, the work of RSM has been entrusted to the Jesuit Fathers of the Antilles Province, and the Jesuits have usually provided the personnel for program directors. The ultimate decision-making is vested in the Roman Catholic bishop of the Diocese of La Vega, but his influence in policy is, at most, indirect.
5. This calculation of costs of both RSM and the adult education program of the Secretariat of Education of the Dominican Republic is based on a much more detailed analysis in Chapter IX of the author's An Alternative Pattern of Basic Education: A Case Study of Radio Santa Maria (UNESCO Institute of Education, 1976).
6. A more detailed presentation of the methodology and the results in this study are found in the author's An Alternative Pattern of Basic Education, Chapter VII. The conditions of the study precluded random assignment of subjects to the experimental (RSM) and control groups (conventional methods), and a design with pre-test and post-test was not possible. The results are valid only as a description of two groups of students, not for establishing a casual relationship between methods and results. However, in an accompanying survey of the two groups of students, it was found that the two different samples were similar in most aspects such as age, aspirations, and other significant characteristics and that they differed only in one major aspect: the Santa Maria students were largely rural and the official students entirely of urban residence. This provides some basis for judging that the difference in examination scores is due not to uncontrolled population characteristics but to the method of teaching. The major uncontrolled factor, rural-urban residence, works to the disadvantage of the RSM students who are rural, so that the results are a conservative estimate of the comparative academic achievement of RSM students.

Reference Notes (continued)

7. A number of studies have indicated that students with an urban background have a significant sociocultural advantage over rural, lower-status students. (See Chain, 1974, p. 252; Mayo, McAnany, and Klees, 1973.) It was also found in the present study that RSM students with urban residence tended to have somewhat higher levels of academic achievement than students with rural residence.
8. The Office of Adult Education in the Secretariat of Education allowed each district office to prepare its own final examination for the adult education schools within its jurisdiction. The sample of the RSM and official adult education students in this study included two districts or two different official examination areas. On the basis of a special rating scale of the level of functioning of the RSM field teachers, it was found that the field teachers in District I tended to have, on the average, a higher level of functioning than field teachers in District II. Such higher levels of functioning of the field teachers were found to be consistently related to higher scores of RSM students on the final sixth and eighth grade examinations.



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